

Naval Research Laboratory

Stennis Space Center, MS 39529-5004



NRL/MR/7332--93-7050

AD-A271 087



Kuroshio Extension Regional Experiment Hydrographic Data: Summer 1992

WILLIAM J. TEAGUE
ZACHARIAH R. HALLOCK

*Ocean Science Branch
Oceanography Division*

JAN M. DASTUGUE

*Ocean Dynamics and Prediction Branch
Oceanography Division*

ALLAN M. SHILLER

*University of Southern Mississippi
Center for Marine Science
Stennis Space Center, MS 39529-5004*

September 1993

Approved for public release; distribution is unlimited.

DTIC
ELECTE
OCT 15 1993
S E D

00 14 040

93-24227



REPORT DOCUMENTATION PAGE

Form Approved
OBM No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. Agency Use Only (Leave blank).		2. Report Date. September 1993	3. Report Type and Dates Covered. Final	
4. Title and Subtitle. Kuroshio Extension Regional Experiment Hydrographic Data: Summer 1992			5. Funding Numbers. Program Element No. 0601153N Project No. 03208 Task No. 3A0 Accession No. DN250131 Work Unit No. 73-5056-A3	
6. Author(s). William J. Teague, Zachariah R. Hallock, Jan M. Dastague, and Alan M. Shiller*				
7. Performing Organization Name(s) and Address(es). Naval Research Laboratory Oceanography Division Stennis Space Center, MS 39529-5004			8. Performing Organization Report Number. NRL/MR/7332--93-7050	
9. Sponsoring/Monitoring Agency Name(s) and Address(es). Naval Research Laboratory Systems, Support, and Requirements Stennis Space Center, MS 39529-5004			10. Sponsoring/Monitoring Agency Report Number. NRL/MR/7332--93-7050	
11. Supplementary Notes. *University of Southern Mississippi Center for Marine Science Stennis Space Center, MS 39529-5004				
12a. Distribution/Availability Statement. Approved for public release; distribution is unlimited.			12b. Distribution Code.	
13. Abstract (Maximum 200 words). The primary focus of the Kuroshio Extension Regional Experiment oceanographic field program is the observation of the hypothetical Pacific Deep Western Boundary Current (DWBC), analogous to the DWBC found in the Atlantic. The model of Stommel, H.M. and A.B. Arons (1990). On the Abyssal Circulation of the World Ocean. I. Stationary Flow Patterns on a Sphere. <i>Deep-Sea Res.</i> 6, 140-154, suggests that a Pacific DWBC should exist but that near Japan it could be northward or southward, depending on model parameters. Observations in this region are relatively sparse. This objective is being addressed with five current meter moorings deployed across the Japan Trench east of Honshu and by a hydrographic section conducted during the deployment cruise in July 1992. This report provides a description of the hydrographic and chemistry data.				
14. Subject Terms. Altimetry, Mesoscale Oceanography, Ocean Forecasting			15. Number of Pages. 68	
			16. Price Code.	
17. Security Classification Unclassified	18. Security Classification of Report. Unclassified	19. Security Classification of This Page. Unclassified	20. Limitation of Abstract. SAR	

Kuroshio Extension Regional Experiment Hydrographic Data: Summer 1992

Introduction

A conductivity-temperature-depth (CTD) hydrographic section was taken across the Kuroshio in the vicinity of 142°E during July 1992. This effort is a part of the Kuroshio Extension Regional Experiment (KERE) field program (Mitchell 1990). KERE contains components at both the Naval Research Laboratory (NRL) and within the Office of Naval Research's Research Programs Department. A total of 18 near full depth CTD/hydrographic stations were completed, each including silica, oxygen, nitrates, and phosphates at standard levels.

The primary focus of the KERE oceanographic field program is the observation of the hypothetical Pacific Deep Western Boundary Current (DWBC), analogous to the DWBC found in the Atlantic. The model of Stommel and Arons (1960) suggests that a Pacific DWBC should exist but that near Japan it could be northward or southward, depending on model parameters. Observations in this region are relatively sparse. This objective is being addressed with five current meter moorings (CMMs) deployed across the Japan Trench east of Honshu and by this section conducted during the deployment cruise.

A secondary focus of the KERE field program is to monitor the variability of the Kuroshio Extension in the vicinity of the CMMs; this is being addressed with an array of inverted echo sounders (IESs). Furthermore, two of the five CMMs have instruments in the thermocline (500 m) in support of this objective. Data from the CMMs and IESs will also be used to interpret and verify altimetry measurements from TOPEX/POSEIDON.

Data Collection

During the transit from Seattle to Yokosuka, Japan, 3 acoustic sources (for RAFOS floats), 7 shallow (1000 m) and 4 deep (3000 m) RAFOS floats and 23 ARGOS surface drifters were deployed. The RAFOS deployments are a component of KERE being conducted by the University of Washington. The surface drifters are a World Ocean Circulation Experiment (WOCE) component. Data from these instruments will not be reported upon here.

On the subsequent cruise (8-23 July 1992) 5 CMMs and 10 IESs were deployed, and 18 CTD/hydrographic stations were conducted. Except for four IESs, all moorings and CTD stations lay along a TOPEX/POSEIDON groundtrack. Forty Expendable Bathythermographs (XBTs) were dropped at IES sites for calibration purposes. Mooring deployments went very well. CMMs and IESs are to be recovered and redeployed for a second year in July 1993.

A Neil Brown Mark III CTD was used in conjunction with a 24-bottle rosette. Water samples were collected at depths ranging from 50-m intervals above the thermocline to 100-m intervals below 3000 m. Over 500 samples were collected. On deeper stations requiring more than 24 samples, 2 casts were conducted. Water samples were analyzed for salinity, dissolved oxygen (O₂), silica (SI), nitrate (NN), and phosphate (PO₄). There were problems with the CTD conductivity sensor after station 9, and a backup CTD was then used for stations 10-18. However, a shift in the deep salinities was observed for the data from this CTD. Since salinities from the first CTD were consistent with historical salinity data (Levitus 1982), salinity data from the second CTD were slightly adjusted to be consistent with the deep salinities from the first CTD.

Oxygen was determined using an automated Winkler system based on the design of Friederich et al. (1991) and using electrometric detection of the endpoint (Culberson and Huang 1987). Reproducibility of standard titrations was $\pm 0.1\%$. The estimated precision across the section (including sampling, titration, and long-term drift errors) is $\pm 1\%$ (one standard deviation).

Nutrients were determined colorimetrically using a Lachat Instruments Quik-Chem AE flow injection analyzer. The nitrate channel of this analyzer actually determines nitrate plus nitrite; however, since nitrite concentrations are usually very low, results here are referred to as nitrate. Ship motion severely affected the phosphate results, and thus, these data should be viewed cautiously. Instrumental drift and day-to-day variability were tracked by running consistency standards before, during, and at the end of each run. Where appropriate, drift corrections were made. Additionally, for several stations, phosphate data were recalculated by hand using the shipboard recorder traces. The estimated precision (one standard deviation) of the nutrient data across the section is $\pm 1.5\%$ for silica, $\pm 1\%$ for nitrate, and $\pm 4\%$ for phosphate.

Chemical data are reported here in modern units of mmol/kg instead of traditional units, which are ml/L for oxygen and mmol/L for nutrients. The use of modern units is preferred for two reasons. First, by using mole-based units (rather than grams or milliliters as is common for dissolved oxygen), no conversion factors are necessary to compare stoichiometric changes in chemical properties. Second, for the denominator, units of mass of seawater are preferred to units of volume since seawater is compressible. Conversion of modern units to traditional per-liter units involves multiplication by the density of seawater (approximately 1.027 kg/L); to convert mmol to ml oxygen, the data should be multiplied by 0.0224.

Expendable CTD (XCTD) data were taken for the purpose of probe evaluation. These data were processed using Sippican algorithms. Some of the XCTD profiles are questionable and include casts 91120125 and 91100002. Cast 91120077 is obviously bad.

Tables provided in this report include Current Meter, IES, CTD, XBT, and XCTD summaries, and a complete listing of the oxygen and nutrients (-99 denotes missing data). Location plots for the various data types appear after the tables, followed by the profile plots for the CTD, XBT, and XCTD. Vertical sections of potential temperature, salinity, potential density, oxygen, silica, nitrate, and phosphate are also shown.

Acknowledgments

Special thanks are extended to the officers and crew of the USNS *DeSteiguer*. Support from Mr. Steve Sova, Dr. Gregg Jacobs, Dr. Charlotte Brunner, Dr. Steve Riser, and Mr. Jim Krest are gratefully acknowledged. This work was supported by the Office of Naval Research under Program Element 0601135N, Dr. H. C. Eppert Jr., Program Manager, as part of the Basic Research Project "Kuroshio Extension Regional Experiment."

References:

Culberson, C. H. and S. Huang 1987. "Automated Amperometric Oxygen Titration," *Deep-Sea Res.* 34, 875-880.

Friederich, G. E., L. A. Codispoti, and C. M. Sakamoto 1991. "An Easy-to-Construct Automated Winkler Titration System," Tech. Rep. 91-96, Monterey Bay Aq. Res. Inst.

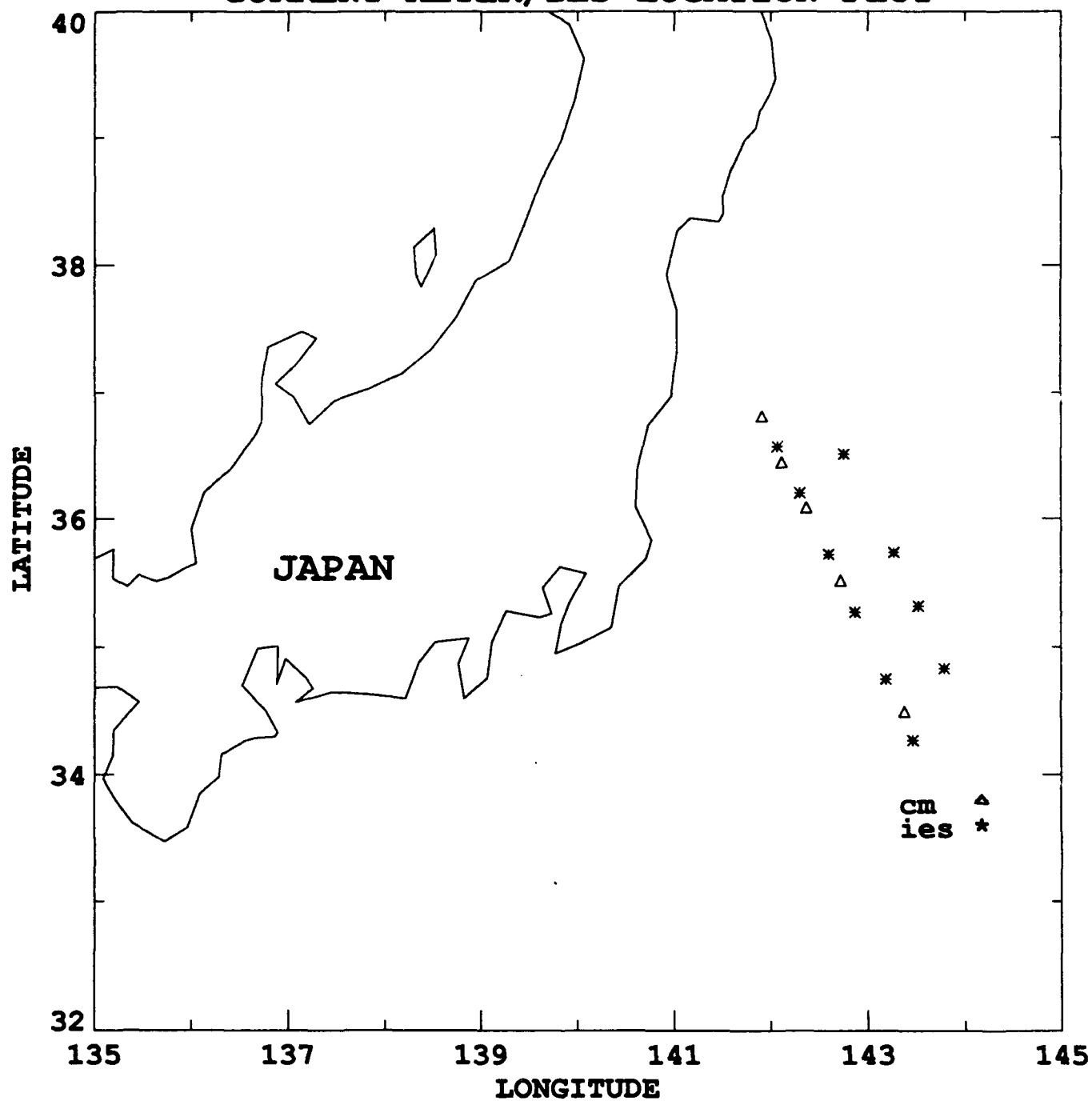
Levitus, S. 1982. "Climatological Atlas of the World Ocean," *NOAA Prof. Paper*, 13, Geophysical Fluid Dynamics Laboratory, Princeton, NJ, 173 pp.

Mitchell, J. L. 1990. "Plans for the Kuroshio Extension Regional Experiment," NOARL Informal Document 016:321:90, Naval Research Laboratory, Stennis Space Center, MS.

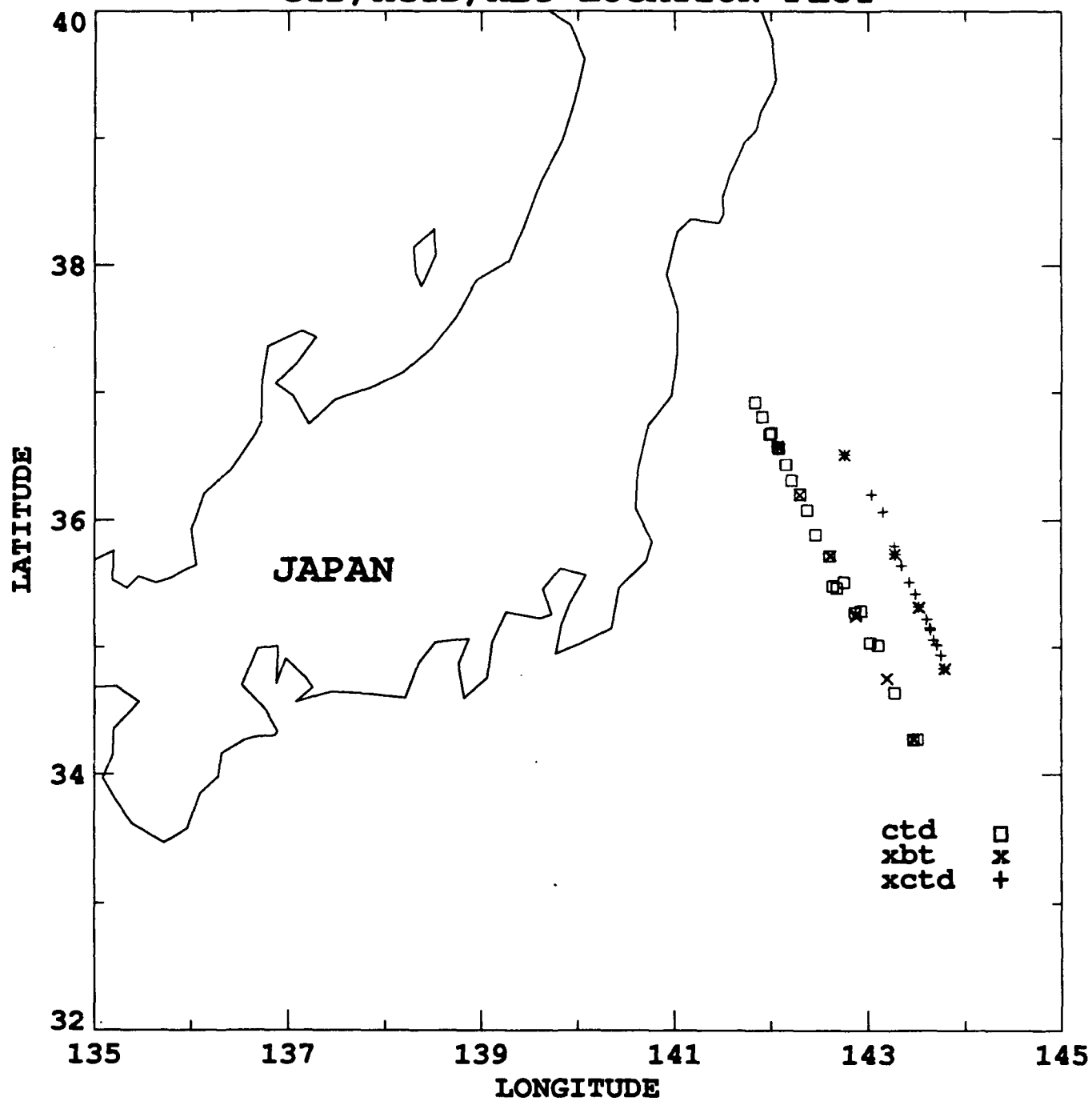
Stommel, H. M. and A. B. Arons 1960. "On the Abyssal Circulation of the World Ocean. I. Stationary Flow Patterns on a Sphere," *Deep-Sea Res.* 6, 140-154.

Accession For	
NTIS	CRA&I <input checked="checked" type="checkbox"/>
DTIC	TAB <input type="checkbox"/>
Unannounced <input type="checkbox"/>	
Justification	
By	
Distribution	
Availability Codes	
Dist	Avail and/or Special
A-1	

CURRENT METER/IES LOCATION PLOT



CTD/XCTD/XBT LOCATION PLOT



CURRENT METER SUMMARY

Array	Day	Lat	Lon	Meter Depth	Bottom Depth
A	192.169	36.812	141.905	2000.	2100.
A	192.169	36.812	141.905	2500.	2100.
B	193.222	36.443	142.107	2000.	3270.
B	193.222	36.443	142.107	3000.	3270.
C	194.058	36.083	142.365	2000	4600.
C	194.058	36.083	142.365	3000	4600.
C	194.058	36.083	142.365	4000	4600.
D	196.321	35.513	142.712	500.	6380.
D	196.321	35.513	142.712	2000.	6380.
D	196.321	35.513	142.712	3000.	6380.
D	196.321	35.513	142.712	5000.	6380.
E	199.135	34.493	143.378	500.	5500.
E	199.135	34.493	143.378	2000.	5500.
E	199.135	34.493	143.378	3000.	5500.
E	199.135	34.493	143.378	5000.	5500.

IES SUMMARY

IES	Day	Lat	Lon	Bottom Depth
1	192.304	36.567	142.067	2630.
2	195.219	36.198	142.300	4100.
3	197.192	35.718	142.598	4200.
4	198.039	35.267	142.868	6000.
5	198.341	34.750	143.183	5400.
6	200.009	34.270	143.467	5600.
7	202.883	36.508	142.755	5700.
8	202.510	35.732	143.280	6200.
9	202.219	35.317	143.517	5500.
10	201.983	34.832	143.785	5700.

CTD SUMMARY

Cast	Day	Lat	Lon	Ztop	Zbot
001001	191.103	36.919	141.833	4.	1013
002002	191.447	36.805	141.905	20.	2131
003003	191.619	36.677	142.000	4	2449
003004	191.776	36.668	141.987	19.	2427
004005	192.410	36.570	142.068	21.	2315
004006	192.573	36.558	142.080	4.	2652
005007	193.359	36.432	142.152	4.	3520
005008	193.938	36.432	142.150	4.	499
006009	194.024	36.312	142.210	4.	3800
009010	194.642	35.885	142.458	4.	4496
007011	195.387	36.203	142.302	4.	4009
008012	195.617	36.080	142.369	4.	4504
011013	196.403	35.467	142.679	4.	2171
011014	196.549	35.483	142.640	6.	6094
011015	196.782	35.514	142.754	23.	2011
010016	197.268	35.717	142.603	25.	3475
012017	197.611	35.275	142.864	8.	5814
012018	197.851	35.285	142.930	24.	408
013019	198.486	35.033	143.019	6.	5416
013020	198.740	35.014	143.102	25.	300
114021	199.234	34.637	143.270	11.	4974
016022	199.553	34.267	143.467	8.	5508
016023	199.753	34.270	143.509	8.	399
017024	200.205	33.900	143.687	9.	4253
018025	200.506	33.437	143.930	9.	5398
018026	200.766	33.449	143.940	9.	299
019027	201.000	32.965	144.212	26.	5312
019028	201.283	32.963	144.217	15.	2203
004029	203.072	36.570	142.065	9.	2420
003030	203.231	36.683	142.002	21.	2402

XBT SUMMARY

Cast	Day	Lat	Lon	Ztop	Zbot
1	192.336	36.573	142.068	0.	800.
2	192.341	36.575	142.068	0.	800.
3	192.345	36.575	142.070	0.	800.
4	192.351	36.577	142.072	0.	800.
5	195.238	36.198	142.298	0.	800.
6	195.247	36.198	142.297	0.	800.
7	195.254	36.198	142.297	0.	800.
8	195.260	36.198	142.295	0.	800.
9	197.201	35.720	142.605	0.	800.
10	197.215	35.722	142.613	0.	800.
11	197.221	35.722	142.615	0.	800.
12	197.226	35.720	142.610	0.	800.
13	198.123	35.263	142.877	0.	800.
14	198.126	35.257	142.873	0.	800.
15	198.130	35.252	142.872	0.	800.
16	198.133	35.245	142.872	0.	800.
17	198.364	34.750	143.193	0.	800.
18	198.376	34.752	143.197	0.	800.
19	198.379	34.752	143.198	0.	800.
20	198.387	34.752	143.200	0.	800.
21	200.017	34.272	143.465	0.	800.
22	200.049	34.272	143.470	0.	800.
24	200.056	34.273	143.473	0.	800.
25	201.989	34.830	143.787	0.	800.
26	201.996	34.830	143.788	0.	800.
27	202.003	34.830	143.792	0.	800.
28	202.009	34.830	143.795	0.	800.
29	202.223	35.315	143.520	0.	800.
30	202.230	35.315	143.523	0.	800.
31	202.238	35.315	143.532	0.	800.
32	202.244	35.313	143.533	0.	800.
33	202.524	35.732	143.278	0.	800.
34	202.530	35.732	143.278	0.	800.
35	202.535	35.732	143.275	0.	800.
36	202.540	35.732	143.275	0.	800.
37	202.894	36.510	142.758	0.	800.
38	202.900	36.510	142.757	0.	800.
39	202.904	36.512	142.757	0.	800.
40	202.911	36.510	142.758	0.	800.

XCTD SUMMARY

Cast	Day	Lat	Lon	Ztop	Zbot
91120120	201.993	34.833	143.783	0.	1000.
91120118	202.062	34.935	143.750	0.	1000.
91120063	202.085	35.017	143.708	0.	145.
91120070	202.088	35.022	143.707	0.	1000.
91120125	202.103	35.058	143.677	0.	1000.
91120119	202.124	35.138	143.643	0.	990.
91120083	202.129	35.152	143.636	0.	133.
91120074	202.147	35.220	143.600	0.	1000.
91120077	202.256	35.320	143.523	0.	1000.
91120082	202.326	35.420	143.490	0.	1000.
91120124	202.358	35.512	143.430	0.	1000.
91120117	202.398	35.643	143.342	0.	645.
91100005	202.428	35.732	143.280	0.	1000.
91100003	202.516	35.732	143.275	0.	1000.
91100006	202.582	35.798	143.272	0.	1000.
91100002	202.665	36.065	143.155	0.	1000.
91100004	202.708	36.200	143.035	0.	1000.
91100009	202.922	36.512	142.760	0.	1000.
91100008	203.072	36.570	142.065	0.	1000.
91100007	203.079	36.572	142.063	0.	1000.
91100012	203.086	36.573	142.062	0.	1000.
91100011	203.093	36.575	142.062	0.	1000.
91100010	203.100	36.578	142.062	0.	500.

CHEMISTRY SUMMARY

KERE STN 001

DEPTH	O2	SI	NN	PO4
10	260.00	0.1	0.00	0.00
50	309.00	7.6	8.50	0.65
100	256.00	28.9	20.90	1.73
150	239.00	44.6	20.90	1.38
200	213.00	63.5	28.00	2.30
250	159.00	76.5	31.00	2.34
300	131.00	86.6	33.40	2.20
350	106.00	90.8	34.40	2.16
400	87.00	98.8	35.40	2.66
450	75.00	102.9	36.10	-99.00
500	64.00	108.6	37.40	2.68
600	49.00	122.1	39.90	-99.00
700	46.00	132.6	40.00	2.98
800	41.00	143.3	40.50	2.94
900	39.00	151.8	41.00	2.87
1000	38.00	156.9	40.90	2.99

KERE STN 002

DEPTH	O2	SI	NN	PO4
10	264.00	0.3	2.30	0.02
50	234.00	13.2	7.70	0.77
100	259.00	18.0	9.70	0.76
150	268.00	28.7	14.90	1.50
200	218.00	43.3	19.90	1.86
250	170.00	59.2	23.60	2.10
350	114.00	92.2	32.20	2.26
400	92.00	97.4	33.60	2.42
450	88.00	93.1	30.00	3.05
500	71.00	100.2	32.80	3.12
600	53.00	123.4	35.40	3.19
700	44.00	132.1	38.70	3.18
800	43.00	140.7	42.60	3.15
900	45.00	140.1	43.80	3.13
1000	44.00	145.4	42.60	2.93
1200	45.00	155.7	42.10	-99.00
1400	49.00	164.5	39.40	3.06
1600	57.00	164.2	38.90	2.91
1800	67.00	161.5	39.70	3.01
1900	0.00	166.7	41.00	2.80

KERE STN 003

DEPTH	O2	SI	NN	PO4
10	243.00	1.0	0.00	0.05
50	253.00	14.1	11.50	0.83
100	219.00	33.0	19.30	1.39
150	234.00	43.6	23.20	1.63
200	193.00	56.5	26.60	1.89
250	154.00	64.6	30.00	2.10
300	146.00	76.2	33.90	2.68
350	119.00	81.7	35.30	2.50
400	97.00	92.0	37.90	2.90
450	78.00	103.5	40.30	2.90
500	68.00	107.4	40.40	2.81
600	42.00	125.0	42.60	3.14
700	55.00	-99.0	-99.00	-99.00
800	41.00	137.0	42.50	3.09
900	41.00	142.4	42.90	2.93
1000	42.00	149.1	43.20	2.98
1200	45.00	157.4	43.40	2.95
1400	50.00	162.2	42.90	2.86
1600	55.00	-99.0	-99.00	-99.00
1800	86.00	170.3	42.40	2.79
2000	83.00	170.4	41.50	2.79
2200	95.00	169.8	40.20	2.71
2400	106.00	169.1	39.10	2.64

KERE STN 004

DEPTH	O2	SI	NN	PO4
10	248.00	1.3	0.00	0.00
50	269.00	16.4	12.80	1.30
100	229.00	36.5	20.80	1.35
150	225.00	46.7	24.20	1.62
200	172.00	58.1	28.00	1.93
250	146.00	66.8	30.80	1.99
300	116.00	76.0	33.60	2.02
350	108.00	86.3	36.60	2.55
400	88.00	96.4	38.90	2.72
450	67.00	109.4	41.50	2.86
500	58.00	114.4	42.50	2.79
600	44.00	125.5	43.00	2.87
700	56.00	-99.0	-99.00	-99.00
800	41.00	139.2	42.80	2.70
900	41.00	146.2	43.20	2.90
1000	43.00	150.4	43.00	2.92
1200	47.00	163.8	42.90	3.20
1400	52.00	163.9	42.70	3.24
2000	83.00	168.7	41.30	3.04
2200	96.00	168.4	40.30	3.00
2400	105.00	168.6	39.70	2.79

KERE STN 005

DEPTH	O2	SI	NN	PO4
10	237.00	3.2	1.10	0.07
50	177.00	23.9	15.20	0.70
100	184.00	31.3	18.30	1.10
150	180.00	42.5	22.70	1.39
200	189.00	49.9	25.20	1.41
250	160.00	63.6	30.30	2.03
300	144.00	75.6	34.00	2.34
400	100.00	87.1	36.40	2.12
500	67.00	105.0	39.90	-99.00
600	47.00	128.7	41.60	2.86
700	41.00	148.2	42.80	-99.00
800	38.00	150.1	42.80	-99.00
900	39.00	151.9	42.90	2.68
1000	40.00	166.3	43.00	3.03
1200	44.00	168.8	43.00	2.97
1400	48.00	169.8	43.00	2.95
1600	57.00	171.4	42.60	2.93
1800	67.00	169.5	41.80	-99.00
2000	82.00	177.7	41.00	2.81
2200	97.00	170.5	40.40	2.94
2400	108.00	173.5	39.90	2.80
2800	126.00	162.2	38.80	2.41
3000	132.00	163.5	38.50	2.60
3300	140.00	164.4	37.60	2.56

KERE STN 006

DEPTH	O2	SI	NN	PO4
10	245.00	2.3	0.00	0.06
50	174.00	23.5	15.10	1.29
100	210.00	27.8	16.40	0.57
200	200.00	46.1	24.70	1.47
250	134.00	59.2	29.20	1.83
300	146.00	74.2	34.30	2.26
400	89.00	98.2	40.70	2.40
500	71.00	102.7	39.80	2.50
600	62.00	111.4	40.70	2.77
700	43.00	132.1	43.30	2.90
800	-99.00	148.8	44.20	-99.00
900	40.00	152.1	44.20	2.76
1000	-99.00	-99.0	-99.00	-99.00
1200	45.00	160.3	44.00	2.74
1400	-99.00	167.1	44.30	2.67
1600	-99.00	-99.0	-99.00	-99.00
1800	69.00	168.3	42.80	-99.00
2000	83.00	168.1	41.50	-99.00

2200	95.00	165.4	41.00	2.42
2400	109.00	-99.0	40.00	2.45
2600	117.00	161.0	39.10	2.31
2800	124.00	-99.0	-99.00	-99.00
3000	132.00	157.6	38.10	-99.00

KERE STN 007

DEPTH	O2	SI	NN	PO4
10	234.00	4.6	1.40	0.03
100	217.00	26.9	16.10	1.26
200	175.00	50.0	24.90	2.20
250	136.00	62.8	29.50	2.28
300	139.00	75.1	33.50	-99.00
400	97.00	95.4	39.50	-99.00
500	72.00	99.6	38.10	-99.00
600	62.00	112.9	40.10	2.82
700	42.00	130.7	42.60	-99.00
900	-99.00	146.2	43.20	-99.00
1100	40.00	157.2	43.50	2.77
1400	49.00	165.9	43.00	-99.00
1600	59.00	166.8	41.90	-99.00
1800	68.00	168.1	41.70	2.94
2000	84.00	168.0	40.80	-99.00
2200	99.00	167.9	40.30	-99.00
2400	108.00	165.9	39.10	-99.00
2600	117.00	162.4	38.60	2.43
2800	125.00	161.1	38.20	-99.00
3000	132.00	160.0	37.70	-99.00
3300	140.00	158.0	37.00	-99.00
3600	-99.00	154.6	36.60	-99.00
3800	151.00	154.6	36.20	-99.00
4000	155.00	154.5	35.60	-99.00

KERE STN 008

DEPTH	O2	SI	NN	PO4
10	261.00	0.7	0.00	-99.00
100	268.00	37.3	21.10	-99.00
200	204.00	59.1	29.60	-99.00
300	156.00	3.8	34.50	-99.00
400	106.00	87.2	38.10	-99.00
500	66.00	103.4	42.10	-99.00
600	55.00	111.4	42.00	-99.00
700	47.00	119.9	42.40	-99.00
1100	41.00	152.2	43.80	-99.00
1400	49.00	162.4	43.60	-99.00
1600	59.00	169.2	42.70	-99.00
1800	70.00	170.8	41.80	-99.00

2000	83.00	-99.0	41.00	-99.00
2200	96.00	164.7	39.90	-99.00
2400	109.00	161.2	39.10	-99.00
2600	118.00	160.4	38.30	-99.00
2800	125.00	158.1	38.30	-99.00
3000	131.00	157.8	37.80	-99.00
3300	139.00	156.9	37.10	-99.00
3600	147.00	-99.0	36.60	-99.00
3900	154.00	153.7	36.50	-99.00
4200	157.00	154.1	36.00	-99.00
4500	160.00	154.1	35.40	-99.00

KERE STN 009

DEPTH	O2	SI	NN	PO4
10	225.00	2.1	0.40	0.00
50	263.00	2.6	0.90	0.00
100	238.00	13.9	10.10	0.00
150	165.00	33.5	18.80	0.15
200	189.00	44.8	23.60	0.00
300	165.00	73.5	33.00	1.74
400	122.00	89.5	37.50	2.76
500	83.00	100.0	39.90	2.17
600	62.00	110.0	42.10	2.78
800	44.00	128.7	42.30	-99.00
1000	53.00	134.7	41.90	-99.00
1200	45.00	150.6	42.30	2.97
1500	48.00	161.9	42.90	3.05
1800	67.00	166.3	41.50	-99.00
2100	90.00	161.4	39.30	2.96
2400	108.00	-99.0	-99.00	-99.00
2700	114.00	-99.0	-99.00	-99.00
3000	129.00	156.4	37.90	-99.00
3300	138.00	154.2	37.00	2.51
3600	147.00	151.9	35.90	2.53
3900	155.00	149.5	35.50	2.50
4200	155.00	148.5	36.20	2.48
4500	161.00	149.9	35.30	2.45

KERE STN 010

DEPTH	O2	SI	NN	PO4
10	216.00	2.0	0.00	-99.00
50	207.00	3.2	3.20	-99.00
100	215.00	3.7	3.90	-99.00
150	213.00	4.8	4.30	-99.00
200	181.00	18.7	10.40	-99.00
300	176.00	35.7	18.60	-99.00
400	198.00	58.4	25.30	-99.00

500	103.00	75.4	29.70	-99.00
600	68.00	104.0	35.40	-99.00
800	-99.00	130.0	38.30	-99.00
1000	49.00	135.0	38.10	-99.00
1200	52.00	140.8	41.60	-99.00
1300	45.00	150.7	-99.00	-99.00
1400	42.00	163.1	-99.00	-99.00
1600	51.00	167.2	-99.00	-99.00
1800	63.00	168.4	-99.00	-99.00
2000	78.00	169.6	-99.00	-99.00
2200	90.00	-99.0	-99.00	-99.00
2400	102.00	166.9	-99.00	-99.00
2600	112.00	166.3	-99.00	-99.00
2800	121.00	164.4	-99.00	-99.00
3000	130.00	163.3	-99.00	-99.00
3300	136.00	162.1	-99.00	-99.00
3500	141.00	-99.0	-99.00	-99.00

KERE STN 011

DEPTH	O2	SI	NN	PO4
10	217.00	1.4	0.00	0.00
50	218.00	2.1	0.00	0.07
100	209.00	4.5	0.00	0.22
150	197.00	6.9	2.00	0.22
200	195.00	9.7	3.60	0.30
250	185.00	12.4	4.60	0.37
300	180.00	18.6	5.90	0.61
400	172.00	31.9	12.50	0.90
500	149.00	50.9	21.00	1.31
600	99.00	75.8	-99.00	1.58
700	71.00	105.1	-99.00	2.72
800	73.00	101.0	-99.00	2.27
900	67.00	115.5	-99.00	2.27
1000	54.00	131.9	-99.00	2.59
1300	53.00	149.8	-99.00	2.87
1400	46.00	-99.0	-99.00	3.22
1600	53.00	-99.0	-99.00	-99.00
1800	63.00	168.2	-99.00	-99.00
2000	74.00	170.4	-99.00	3.21
2200	102.00	-99.0	-99.00	-99.00
2400	102.00	-99.0	-99.00	-99.00
2600	107.00	154.8	-99.00	2.81
2800	120.00	157.0	-99.00	2.81
3000	129.00	154.7	-99.00	2.73
3300	135.00	-99.0	-99.00	-99.00
3600	142.00	150.0	-99.00	-99.00
3900	143.00	-99.0	-99.00	2.43
4200	155.00	147.7	-99.00	-99.00
4600	150.00	147.2	-99.00	2.36
5000	163.00	145.4	-99.00	2.48
5400	165.00	-99.0	-99.00	-99.00

5800	166.00	143.0	-99.00	-99.00
6050	167.00	144.6	-99.00	2.45

KERE STN 012

DEPTH	O2	SI	NN	PO4
10	218.00	0.0	0.10	0.05
50	228.00	1.9	0.00	-99.00
100	216.00	3.0	2.20	0.30
150	198.00	4.8	5.00	0.30
200	216.00	4.2	4.00	0.34
250	196.00	7.1	6.90	0.46
300	187.00	10.2	9.20	0.65
400	170.00	22.0	15.10	0.76
500	164.00	33.4	20.00	0.99
600	142.00	51.3	25.70	1.72
700	120.00	72.0	31.90	1.99
800	81.00	93.3	36.90	2.66
900	68.00	105.0	37.80	2.66
1000	50.00	123.1	40.90	2.66
1200	62.00	131.3	40.20	2.72
1400	49.00	151.4	42.20	-99.00
1600	55.00	162.7	42.40	2.88
1800	63.00	168.0	41.70	2.99
2000	74.00	170.2	41.10	2.78
2200	89.00	170.3	40.30	2.78
2400	99.00	164.7	40.10	2.78
2600	111.00	163.0	39.20	-99.00
2800	120.00	161.7	38.60	-99.00
3000	127.00	158.6	37.90	-99.00
3300	134.00	156.6	37.20	2.52
3600	142.00	151.6	36.60	2.72
3900	149.00	151.4	36.20	2.66
4200	154.00	148.5	35.80	2.66
4600	159.00	146.4	35.50	2.52
5000	162.00	147.1	35.10	-99.00
5400	164.00	145.2	34.90	2.45
5800	166.00	147.5	34.80	2.48

KERE STN 013

DEPTH	O2	SI	NN	PO4
10	217.00	1.3	0.00	0.00
50	216.00	2.2	1.40	0.00
100	222.00	2.4	1.50	0.00
150	220.00	2.8	2.50	0.00
200	224.00	3.1	2.80	0.00
250	226.00	3.4	3.00	0.00
300	222.00	3.8	3.40	0.00

400	-99.00	13.5	10.70	0.59
500	172.00	26.8	16.60	0.95
600	159.00	41.5	21.90	1.35
700	148.00	60.0	27.60	1.83
800	115.00	76.0	32.10	2.12
900	85.00	93.3	35.40	-99.00
1000	59.00	113.5	39.10	2.79
1200	48.00	134.5	41.20	2.86
1500	48.00	156.1	42.30	3.01
1600	48.00	161.2	42.10	2.98
1800	54.00	167.3	41.90	2.94
2000	67.00	171.1	41.10	2.91
2200	82.00	168.9	40.20	2.80
2400	93.00	169.3	39.40	2.80
2600	105.00	168.0	38.50	2.76
2800	116.00	164.7	38.00	-99.00
3000	124.00	162.0	37.40	-99.00
3300	132.00	159.5	36.80	-99.00
3600	140.00	159.2	36.30	2.56
3900	147.00	157.8	35.90	2.44
4200	152.00	155.8	35.60	2.40
4600	158.00	153.8	35.00	2.33
5000	162.00	151.4	34.40	2.21

KERE STN 014

DEPTH	O2	SI	NN	PO4
10	220.00	1.8	0.00	0.00
50	233.00	2.3	0.00	0.07
100	220.00	2.6	1.90	0.34
200	220.00	3.8	3.10	0.34
300	221.00	3.9	3.70	0.37
400	188.00	10.4	9.00	0.47
600	160.00	32.6	19.30	1.48
800	129.00	64.9	29.70	2.22
1000	70.00	102.9	38.10	-99.00
1200	48.00	129.8	41.10	-99.00
1400	48.00	151.7	41.60	3.00
1600	46.00	156.6	42.20	3.06
1800	68.00	-99.0	-99.00	-99.00
2000	64.00	168.4	41.70	-99.00
2200	79.00	169.8	40.60	-99.00
2400	91.00	167.1	39.70	-99.00
2600	101.00	165.6	39.20	2.68
2800	112.00	162.7	38.40	2.65
3200	129.00	162.2	37.60	2.59
3600	142.00	159.0	37.00	2.59
3900	146.00	157.4	36.50	2.56
4200	154.00	-99.0	36.10	2.59
4600	158.00	152.9	35.60	2.59
5000	162.00	-99.0	35.40	2.56

KERE STN 016

DEPTH	O2	SI	NN	PO4
10	220.00	1.7	0.00	0.00
50	219.00	3.0	0.80	0.00
100	220.00	2.2	1.60	-99.00
150	221.00	2.5	2.40	0.08
200	222.00	2.9	2.70	-99.00
250	225.00	3.2	3.00	0.18
300	225.00	3.3	3.00	0.26
400	208.00	5.0	5.40	0.30
500	184.00	13.2	11.00	0.58
600	173.00	24.5	16.50	0.87
700	160.00	36.9	21.30	-99.00
800	158.00	55.3	27.10	1.38
900	106.00	79.7	34.00	1.90
1000	75.00	97.5	37.50	2.60
1200	51.00	125.7	41.00	2.67
1400	43.00	142.8	42.10	2.98
1600	45.00	155.1	42.50	2.90
1800	50.00	-99.0	42.50	2.90
2000	62.00	166.1	41.60	2.81
2200	73.00	169.5	41.00	-99.00
2400	87.00	-99.0	-99.00	2.76
2600	-99.00	166.4	39.20	2.64
2800	113.00	164.9	38.60	2.64
3000	121.00	-99.0	38.00	2.54
3300	132.00	157.5	37.20	2.40
3600	140.00	-99.0	36.50	2.54
3900	147.00	158.7	36.20	-99.00
4000	148.00	157.0	36.10	2.47
4200	152.00	156.0	35.80	2.47
4600	157.00	152.7	35.40	2.47
5000	162.00	149.9	35.10	2.43
5400	164.00	147.3	35.10	2.40

KERE STN 017

DEPTH	O2	SI	NN	PO4
10	219.00	1.5	0.00	0.00
50	224.00	2.1	0.00	0.07
100	223.00	2.9	1.30	0.15
150	219.00	2.4	2.40	-99.00
200	219.00	3.2	2.90	0.18
300	224.00	3.4	3.10	0.27
400	205.00	-99.0	5.70	0.28
600	176.00	21.2	15.20	1.25
800	154.00	52.0	26.20	2.00
1000	81.00	93.7	36.70	2.35
1200	61.00	115.8	39.00	2.68

1400	48.00	140.3	41.30	2.95
1600	58.00	-99.0	-99.00	-99.00
1800	52.00	162.7	42.50	3.00
2000	65.00	167.0	41.80	-99.00
2200	85.00	-99.0	-99.00	-99.00
2600	110.00	-99.0	-99.00	-99.00
2800	113.00	164.8	38.70	-99.00
3000	125.00	162.8	37.90	-99.00
3300	133.00	160.2	37.60	-99.00
3600	142.00	158.1	37.00	2.52
3900	149.00	155.8	36.20	2.48
4250	155.00	154.1	36.00	2.48

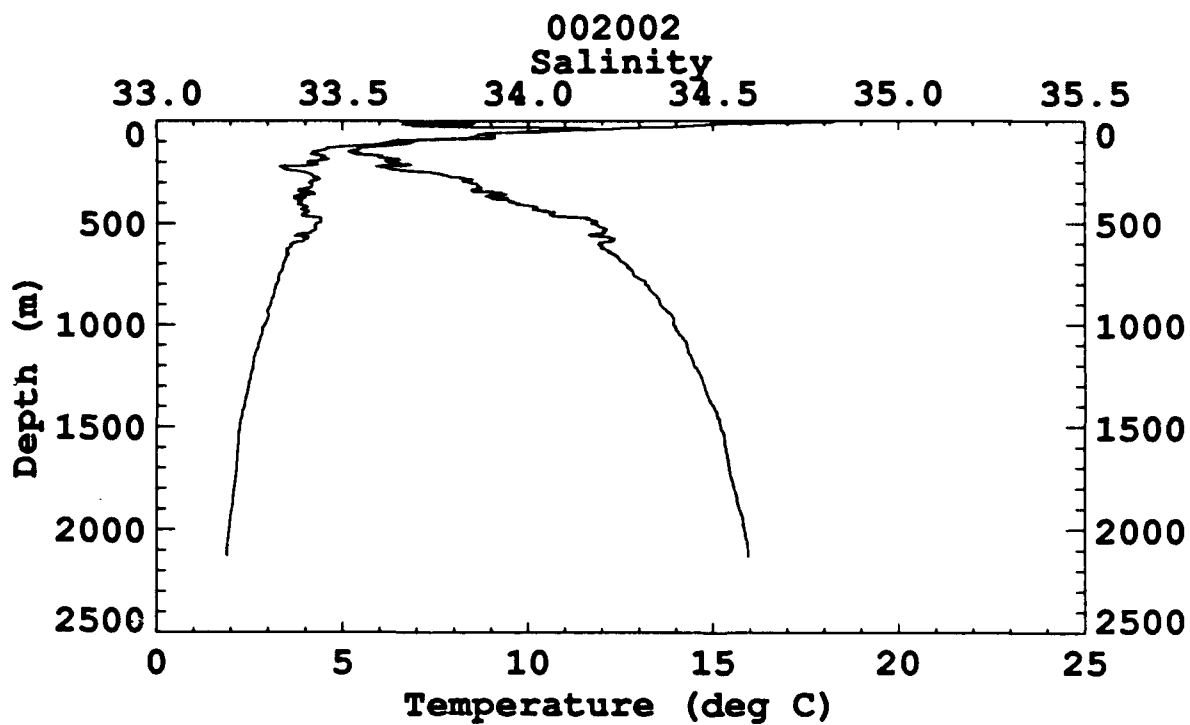
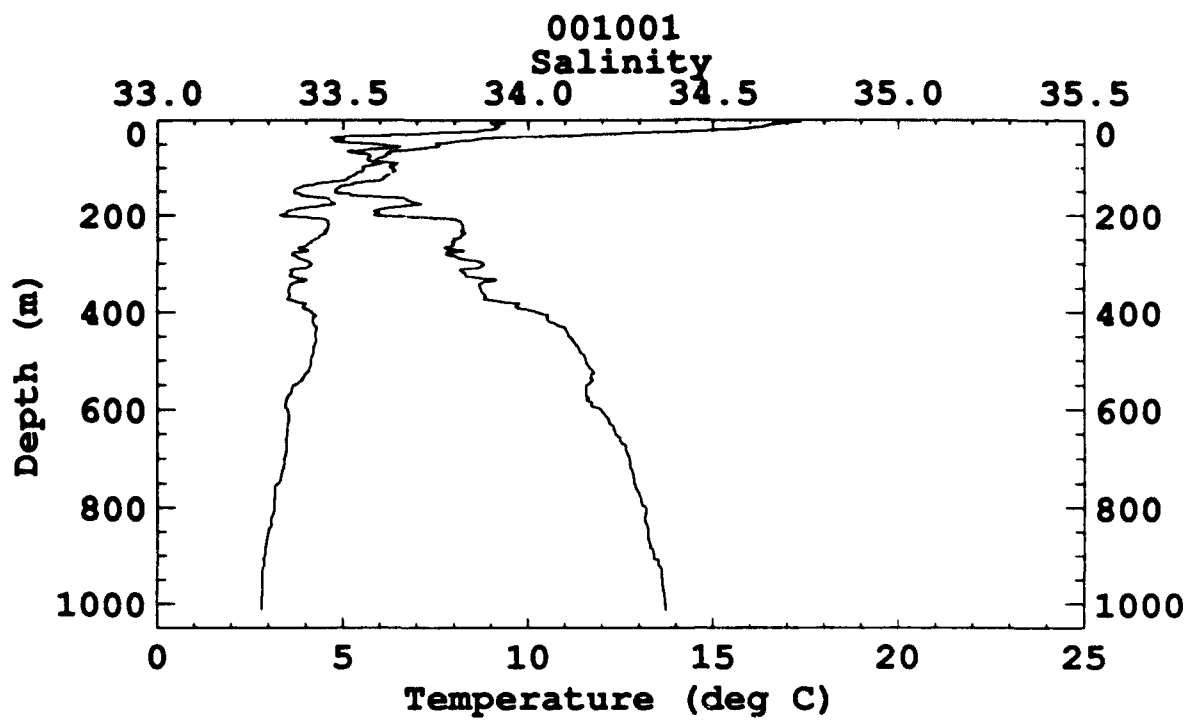
KERE STN 018

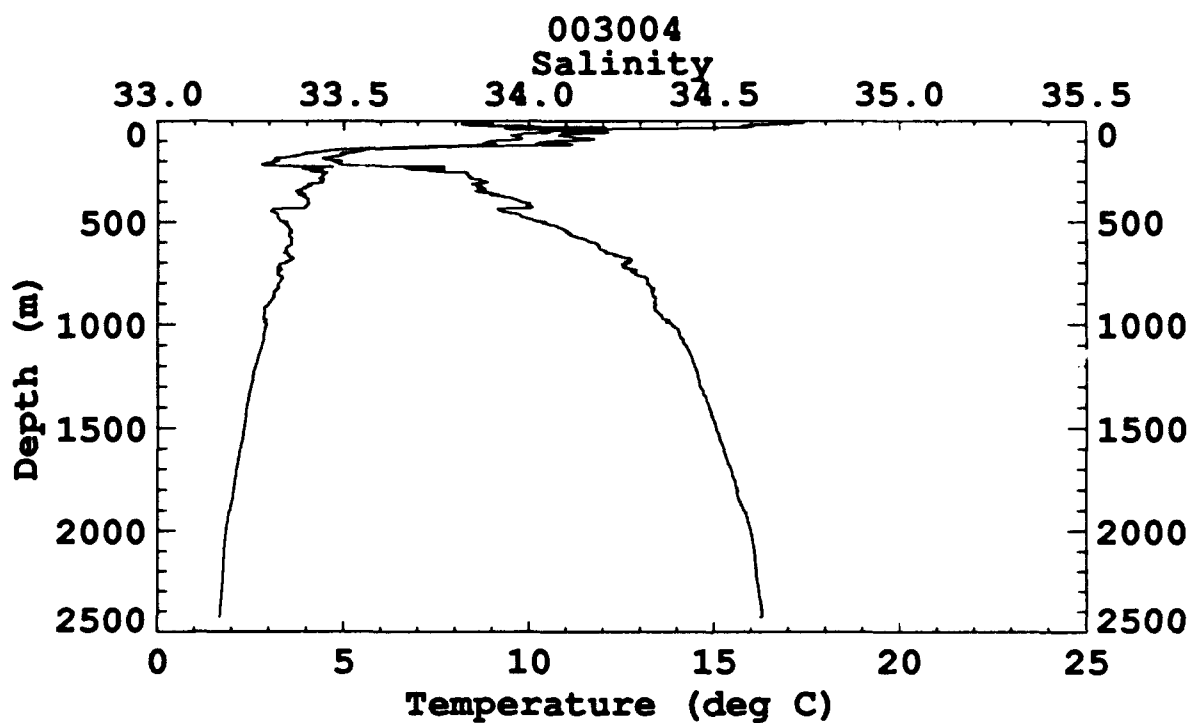
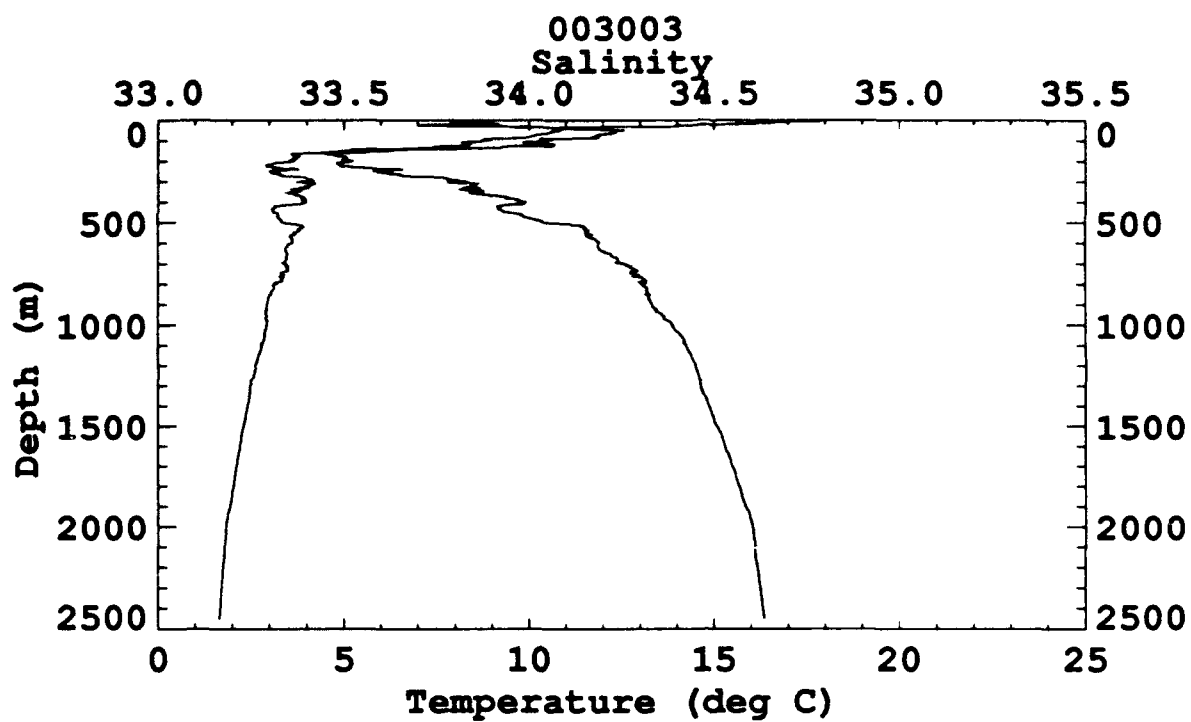
DEPTH	O2	SI	NN	PO4
10	218.00	1.8	0.00	0.00
50	228.00	2.0	0.00	0.00
100	217.00	2.7	1.60	0.05
150	218.00	3.2	2.40	-99.00
200	220.00	3.2	2.80	0.33
250	222.00	3.6	3.00	-99.00
300	224.00	3.5	3.20	-99.00
400	195.00	7.3	7.20	1.02
500	180.00	8.0	11.70	1.18
600	162.00	28.6	17.50	1.33
700	166.00	40.4	22.20	1.49
800	142.00	64.7	29.20	-99.00
900	100.00	-99.0	33.40	2.35
1000	69.00	101.6	37.20	-99.00
1200	-99.00	125.8	39.90	2.58
1400	46.00	143.9	41.00	-99.00
1600	47.00	158.1	41.70	2.83
1800	58.00	163.9	-99.00	2.94
2000	66.00	168.3	40.90	2.97
2200	82.00	-99.0	-99.00	-99.00
2400	94.00	168.8	39.40	2.87
2600	106.00	166.8	38.60	-99.00
2800	119.00	-99.0	-99.00	-99.00
3000	128.00	-99.0	-99.00	-99.00
3300	135.00	-99.0	-99.00	-99.00
3600	142.00	160.1	36.40	2.56
3900	149.00	155.2	35.60	2.48
4200	154.00	152.3	36.10	2.39
4600	160.00	149.7	36.00	2.32
5000	163.00	147.6	35.40	2.32
5400	165.00	146.7	35.10	-99.00

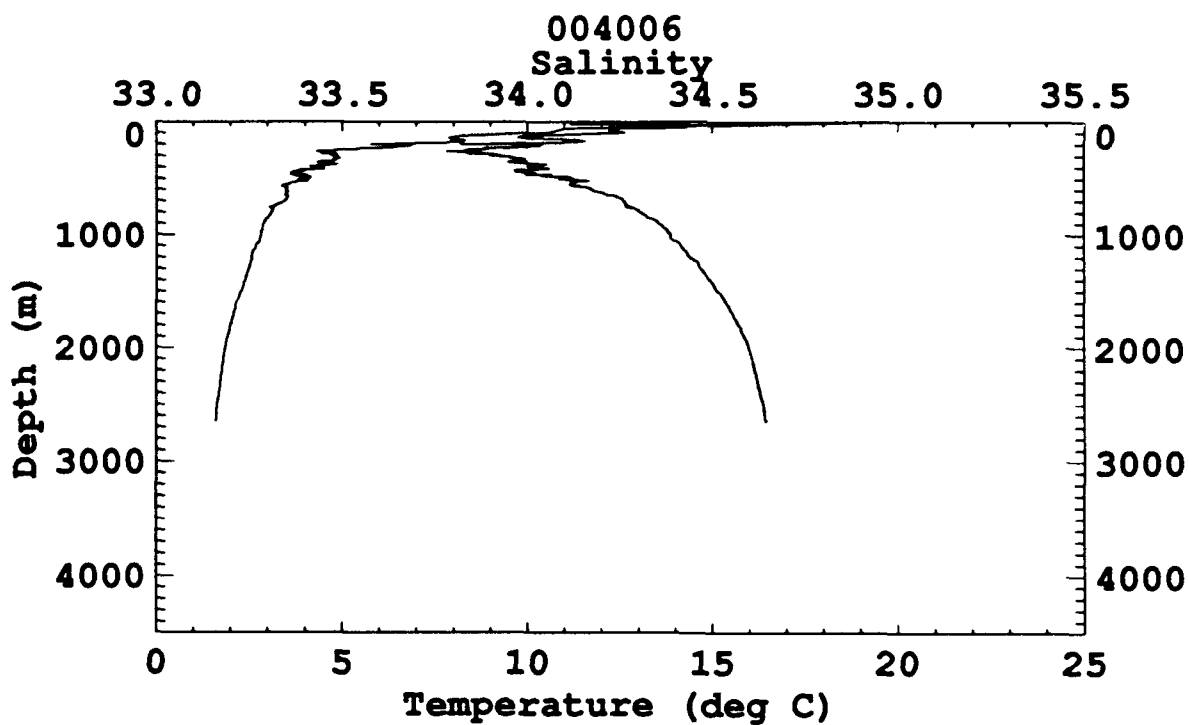
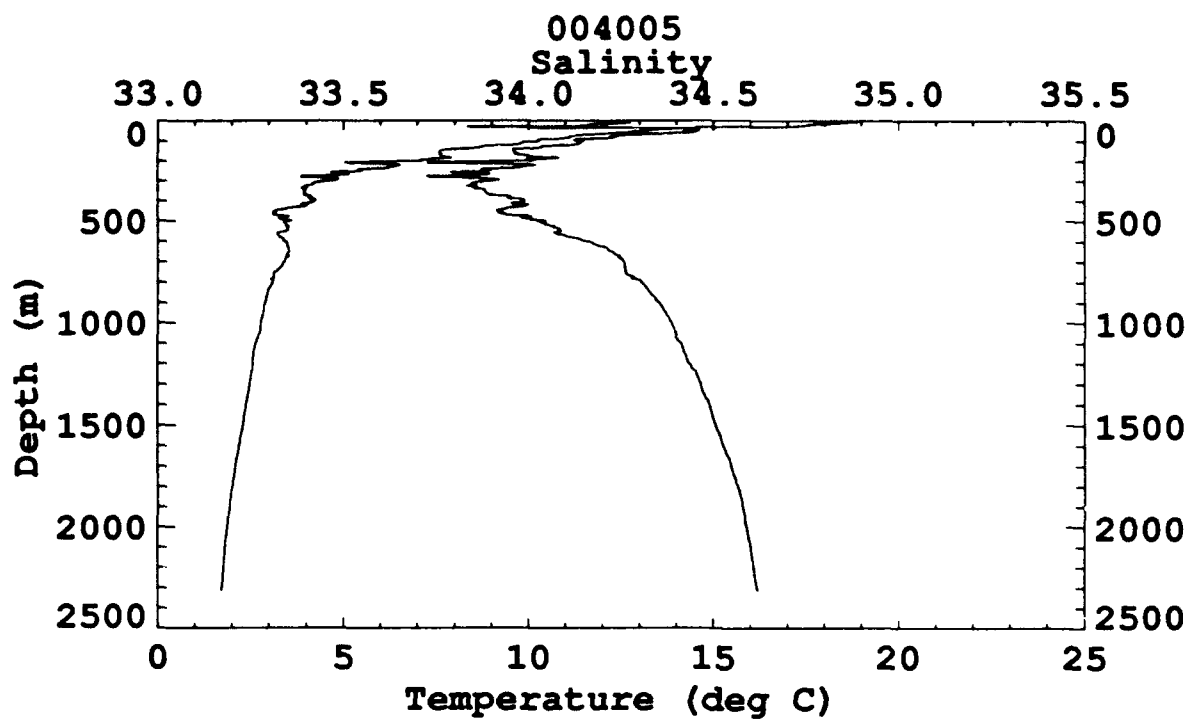
KERE STN 019

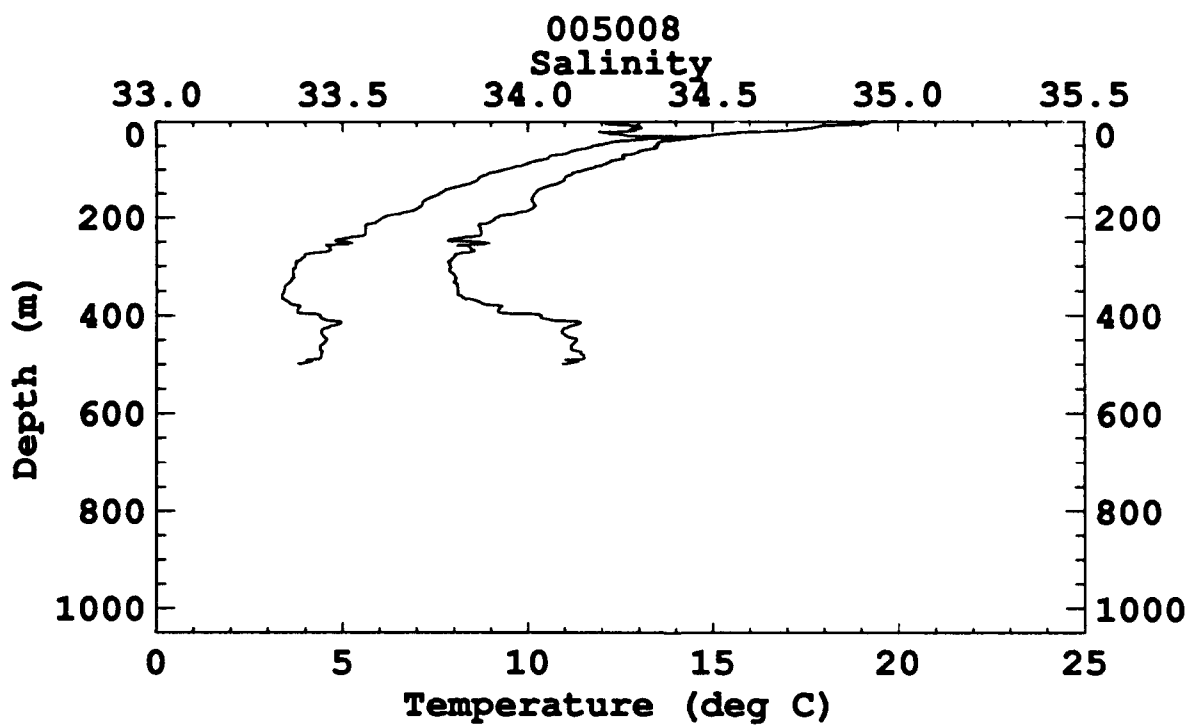
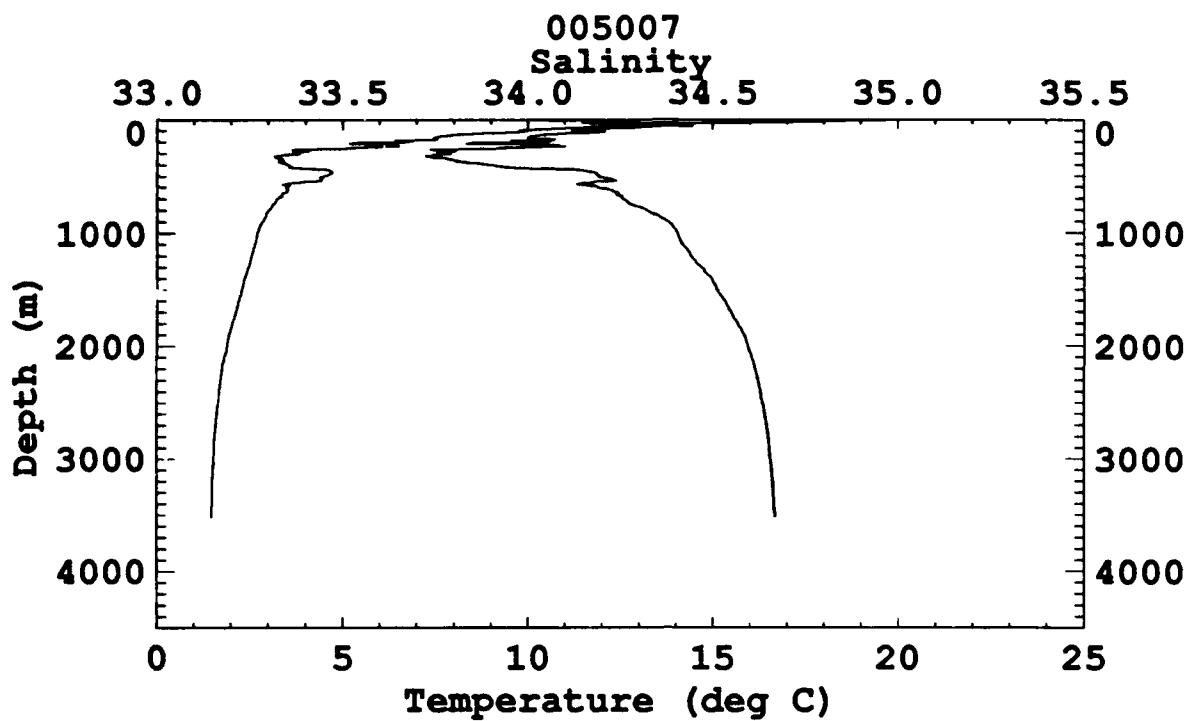
DEPTH	O2	SI	NN	PO4
10	213.00	0.0	0.10	-99.00
50	224.00	2.3	0.10	-99.00
100	207.00	3.5	2.90	0.08
150	222.00	2.1	2.00	0.00
200	218.00	3.0	3.00	0.08
250	221.00	3.3	3.30	0.11
300	223.00	3.4	3.40	0.15
400	188.00	9.6	9.10	-99.00
500	175.00	18.8	14.60	-99.00
600	167.00	33.0	19.70	-99.00
700	158.00	50.7	25.70	-99.00
800	173.00	69.6	32.10	-99.00
900	89.00	88.3	36.10	-99.00
1000	68.00	103.8	39.20	-99.00
1200	87.00	-99.0	-99.00	-99.00
1400	43.00	151.4	43.00	2.91
1600	46.00	161.5	42.30	2.81
1800	53.00	167.3	42.40	2.73
2000	69.00	-99.0	-99.00	-99.00
2200	80.00	171.9	40.20	2.66
2400	93.00	170.5	40.30	-99.00
2600	105.00	168.1	39.90	-99.00
2800	116.00	-99.0	-99.00	-99.00
3000	124.00	-99.0	-99.00	-99.00
3300	132.00	-99.0	-99.00	-99.00
3900	148.00	157.4	36.70	-99.00
4200	154.00	155.2	36.10	-99.00
4600	160.00	152.7	35.80	-99.00
5000	163.00	149.6	35.30	-99.00
5314	165.00	147.9	35.40	-99.00

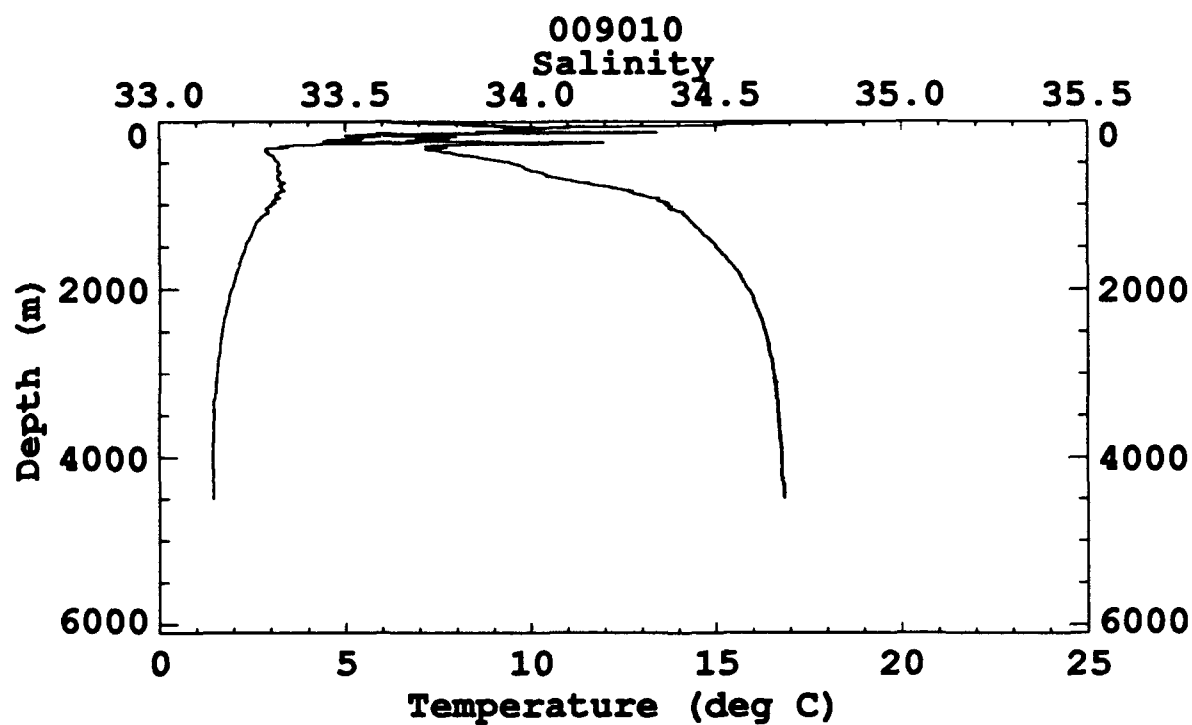
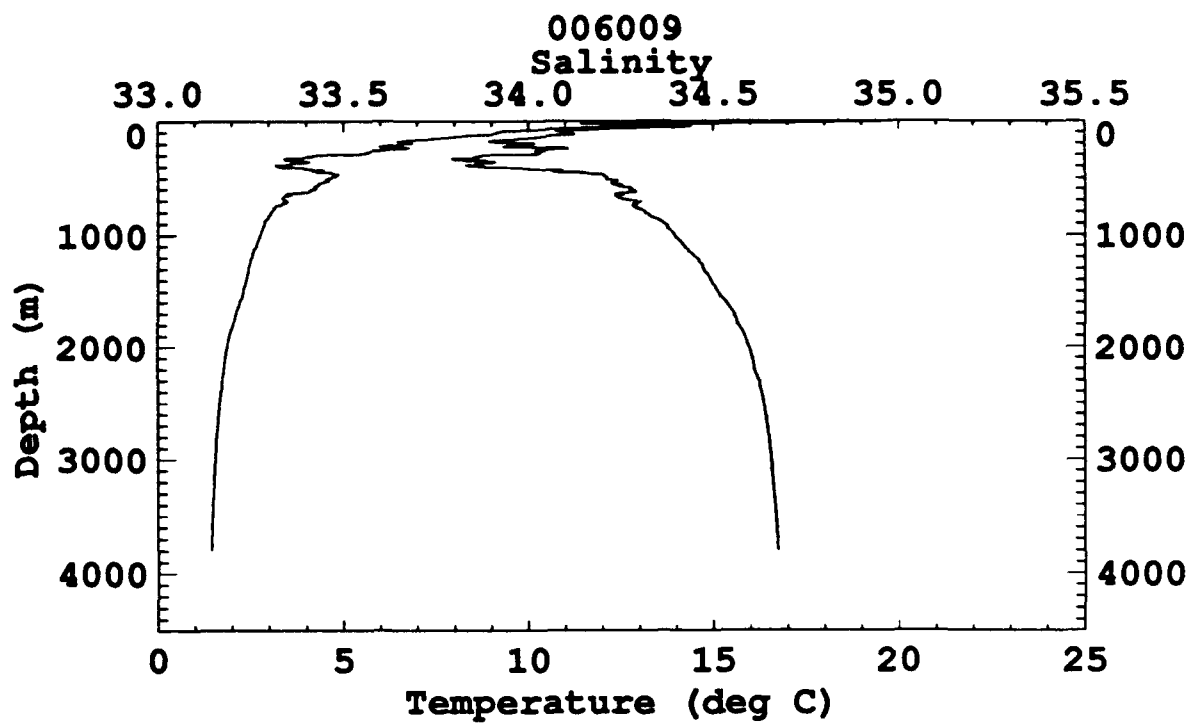
CTD PROFILES

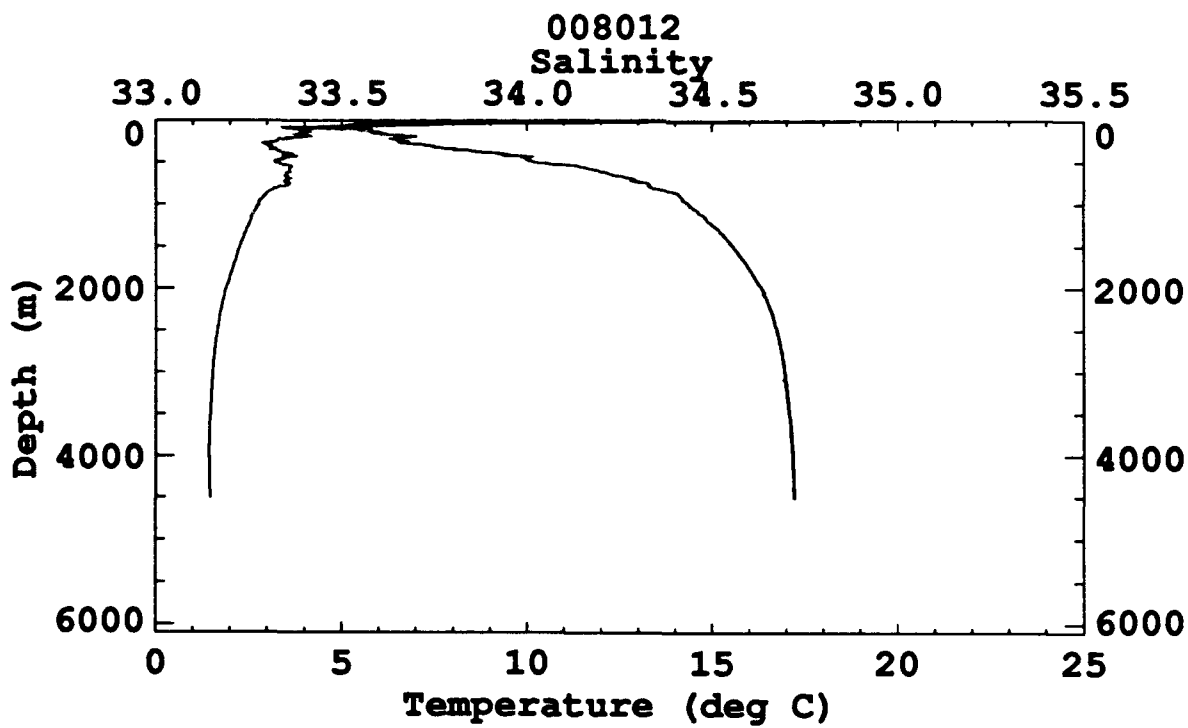
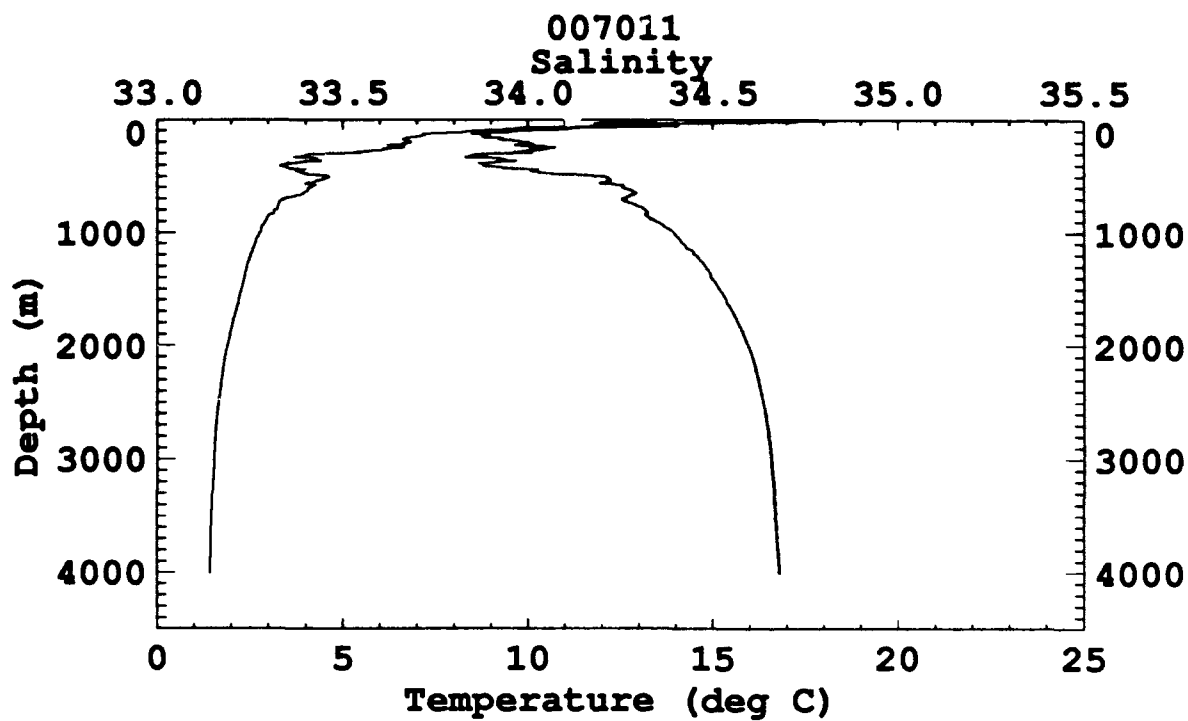


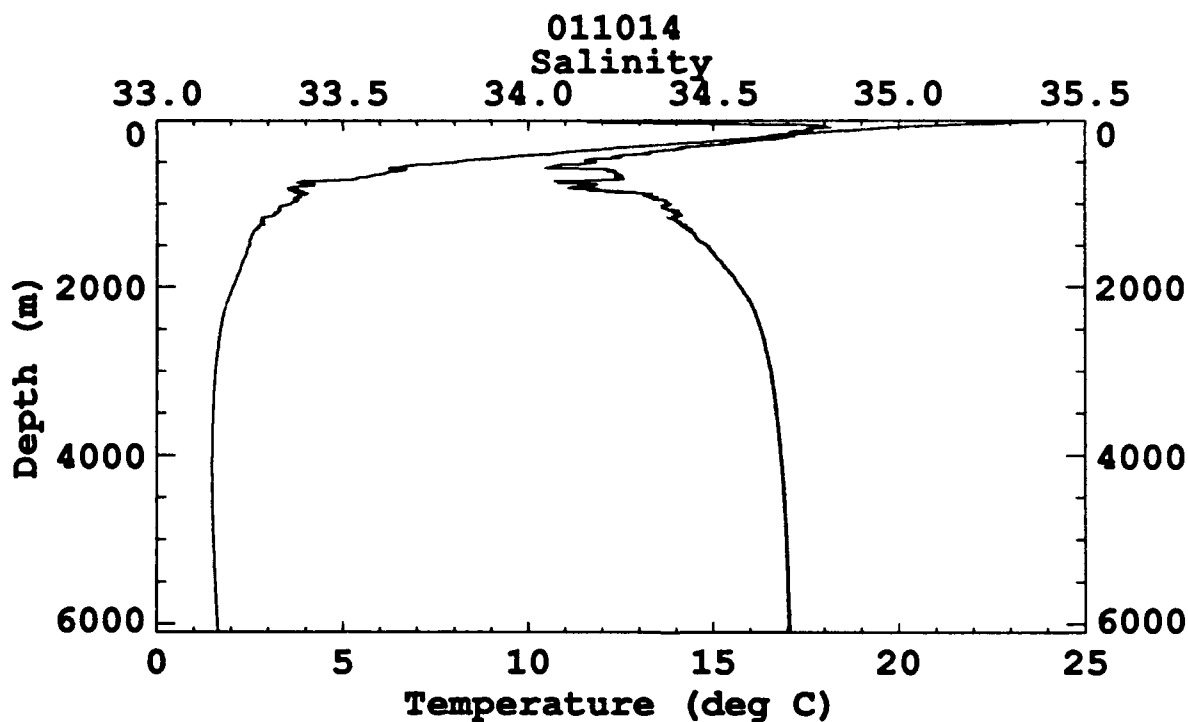
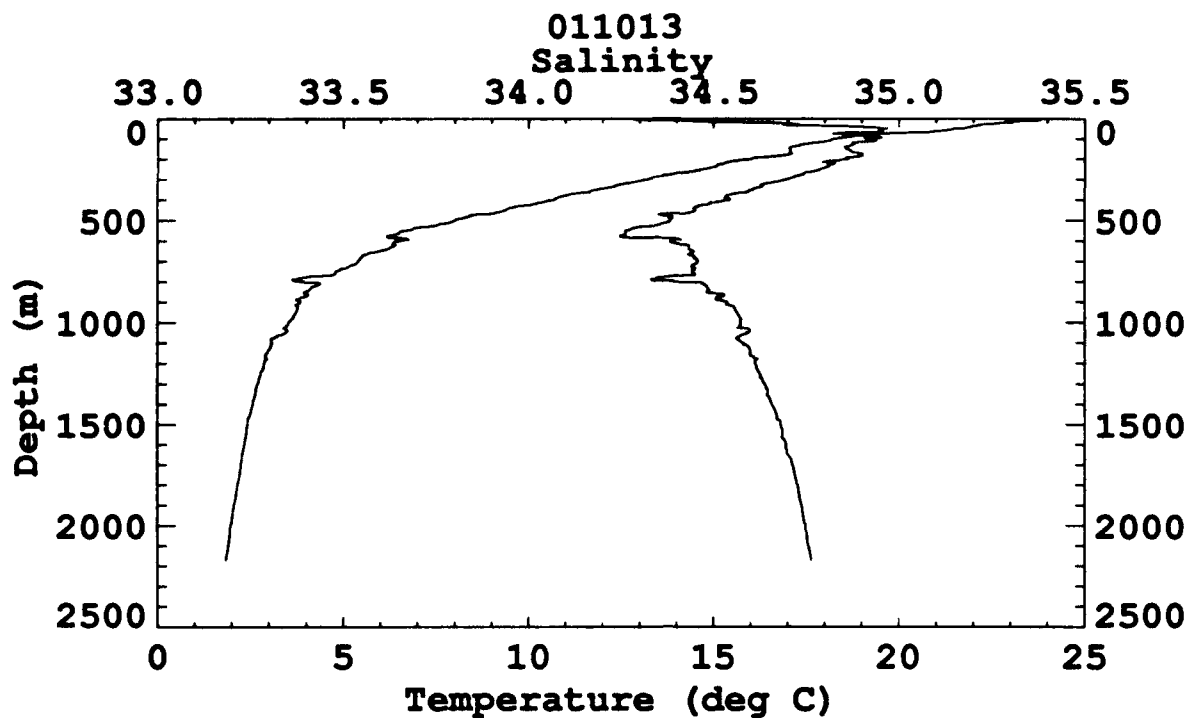


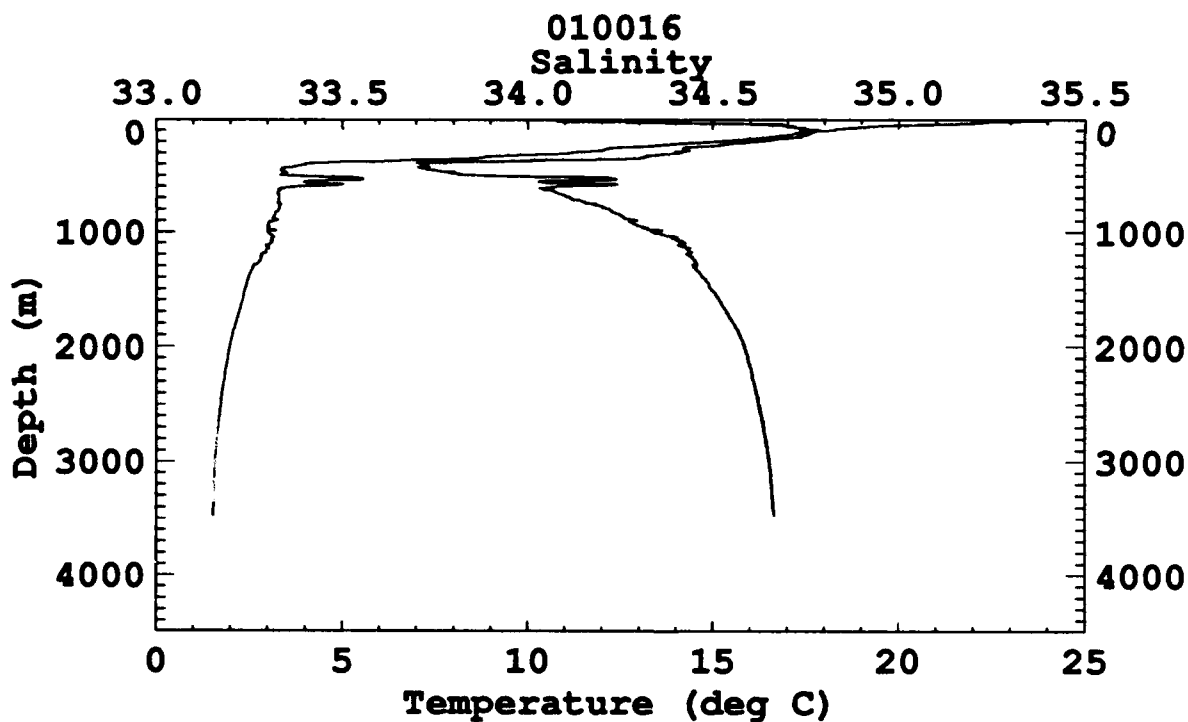
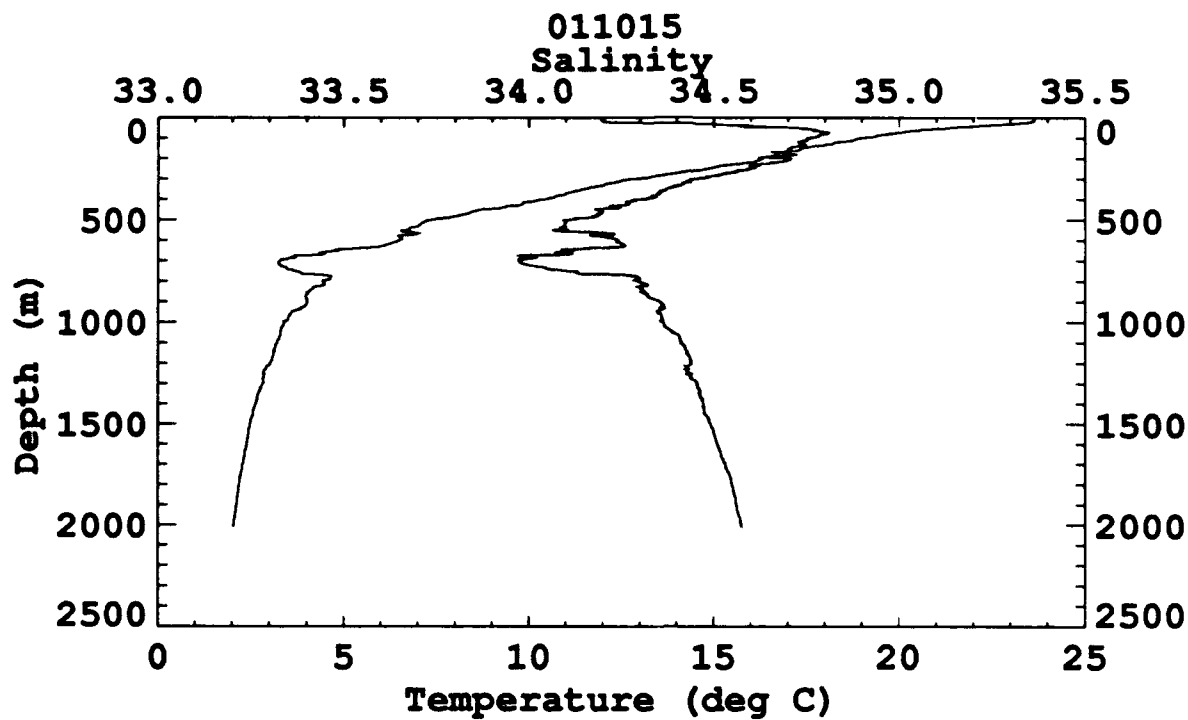


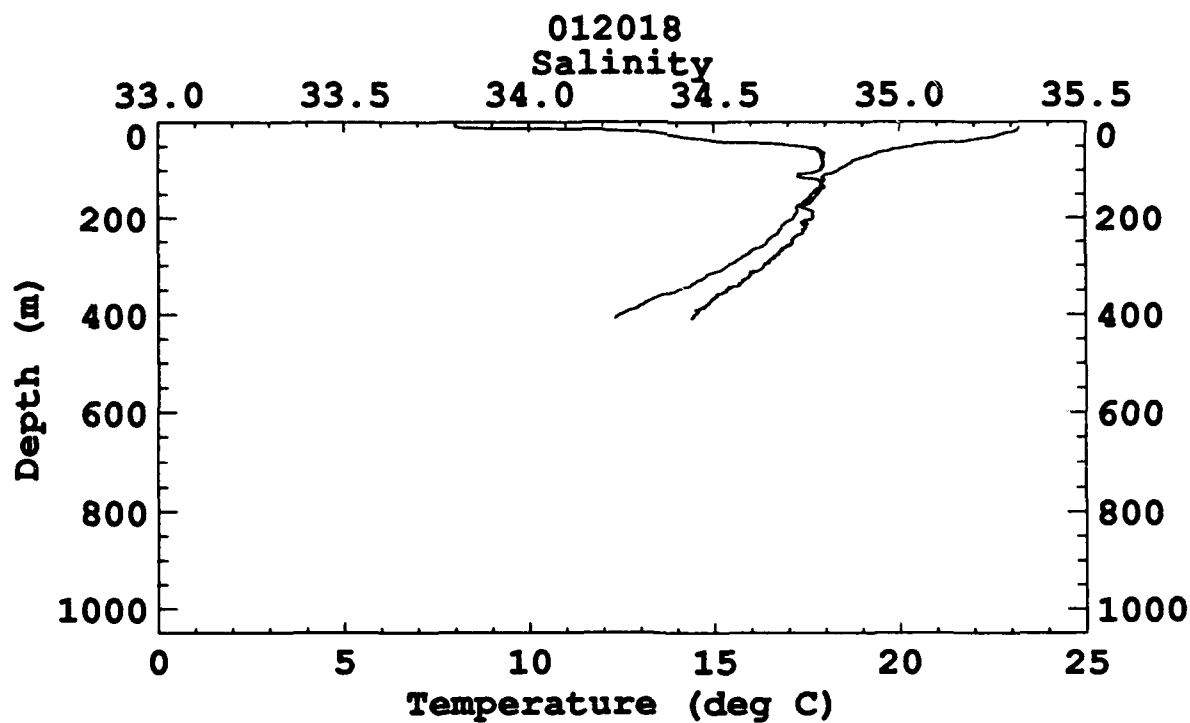
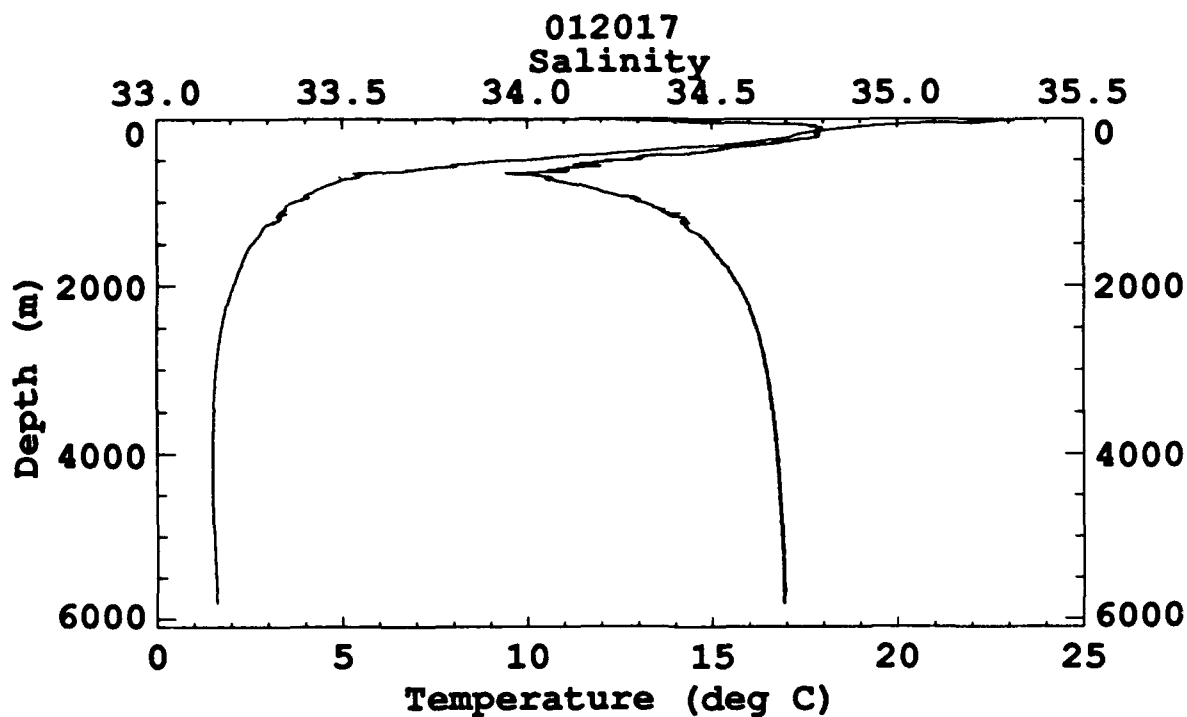


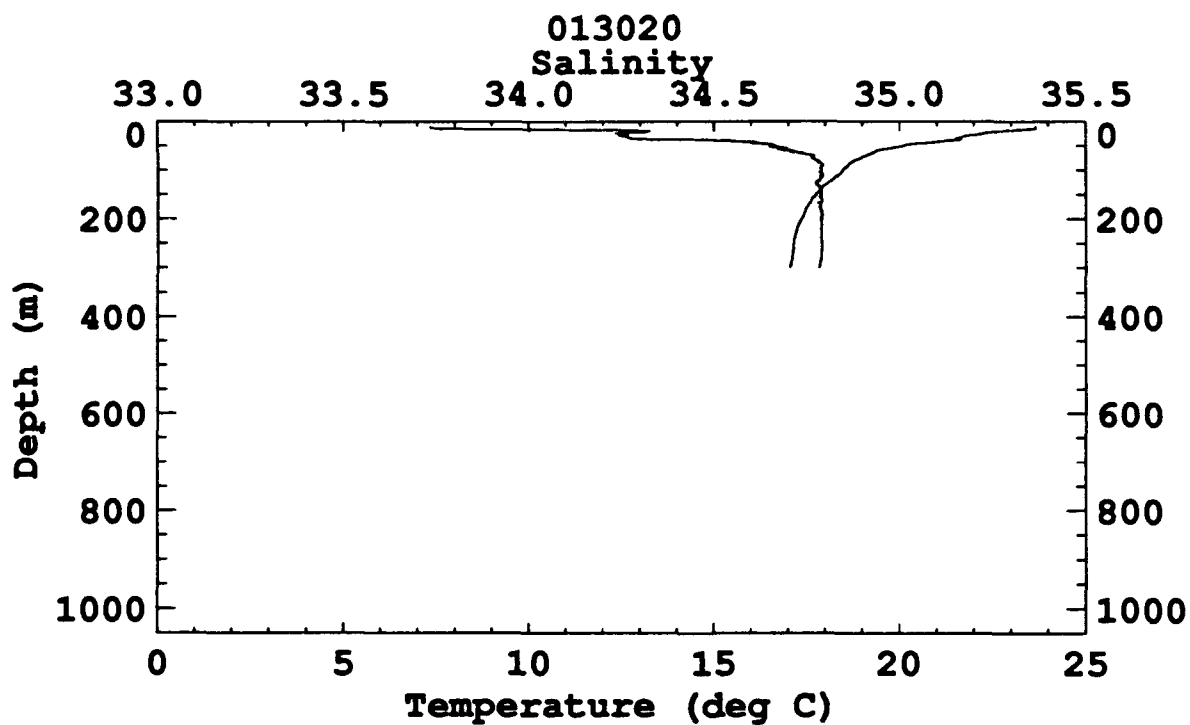
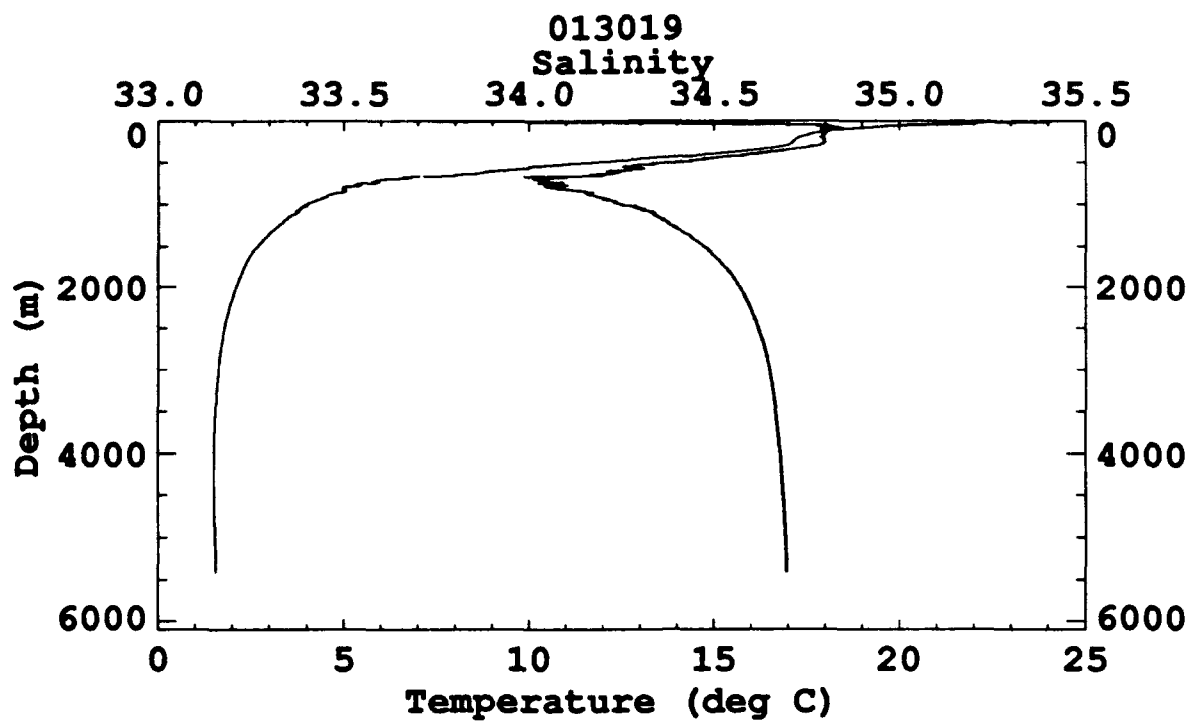


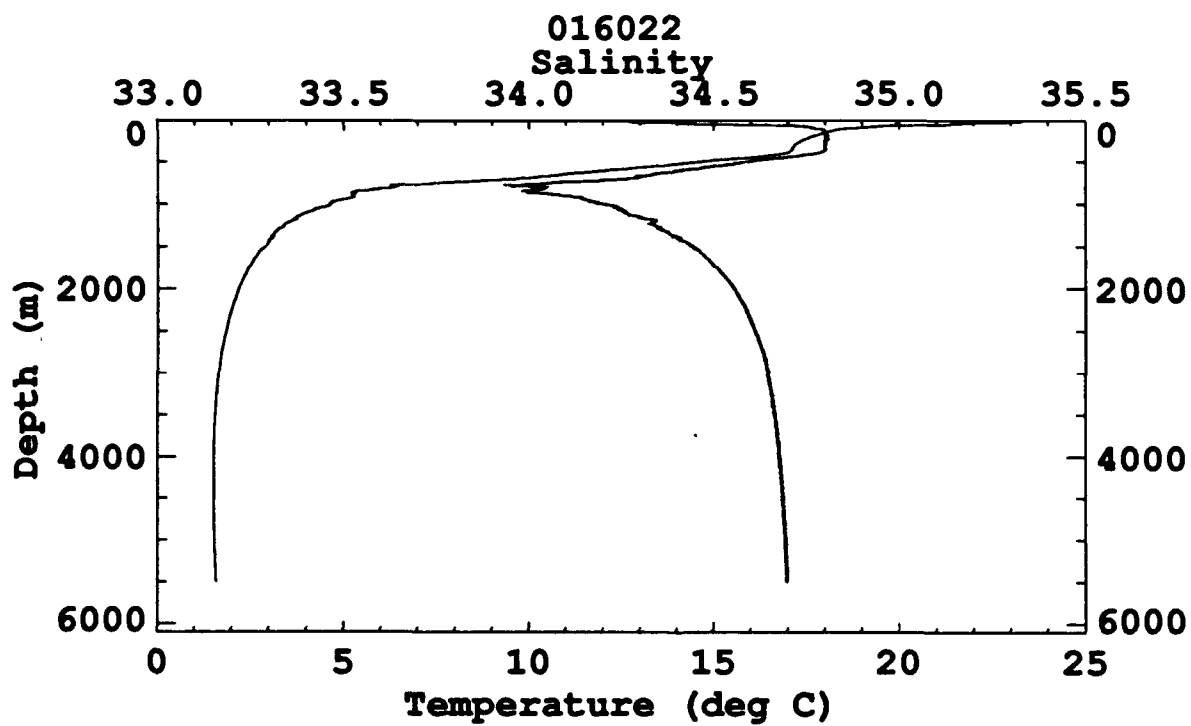
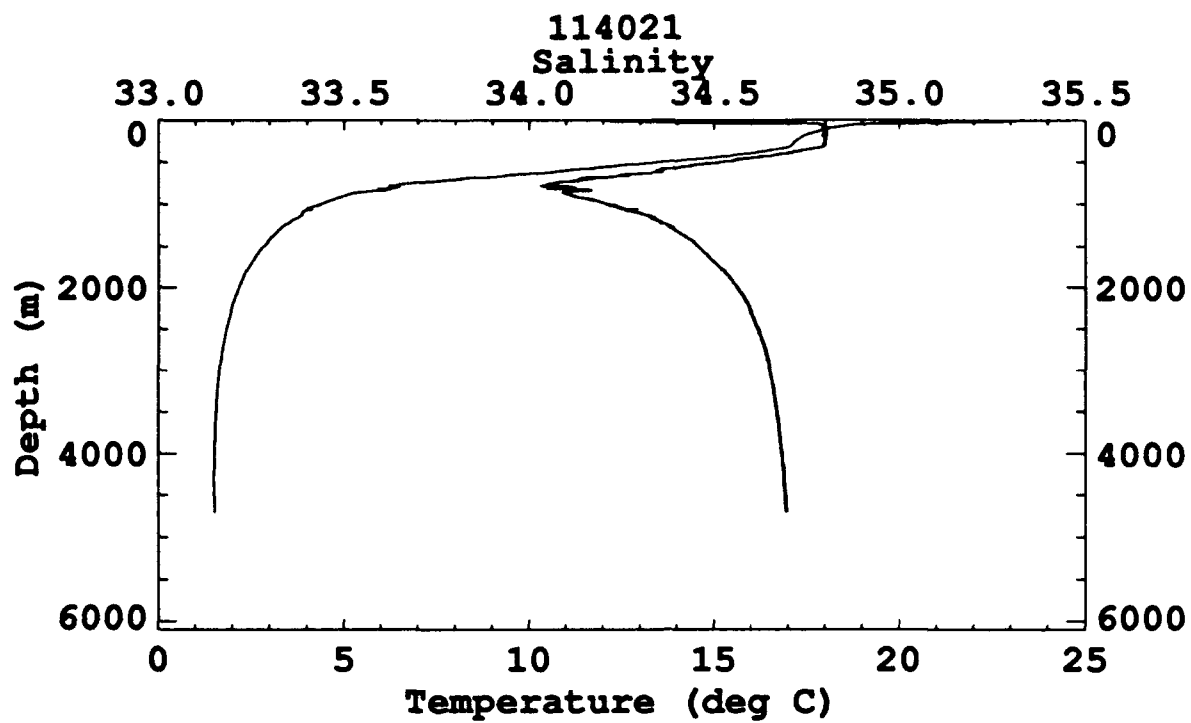


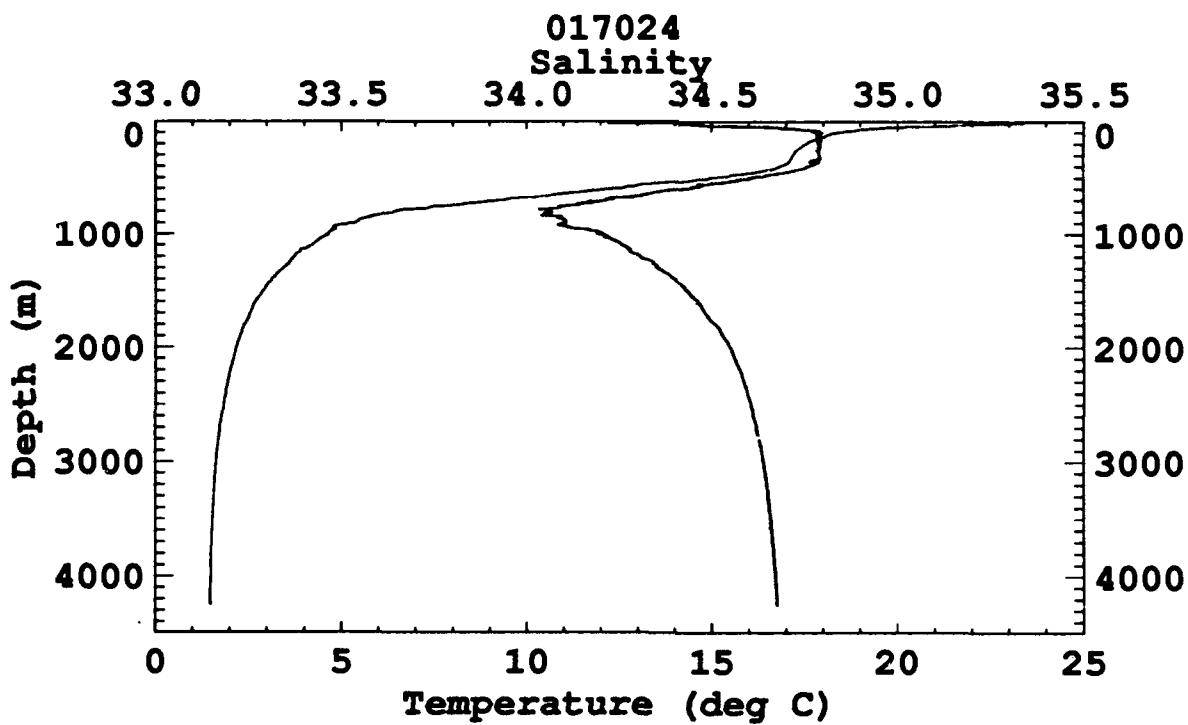
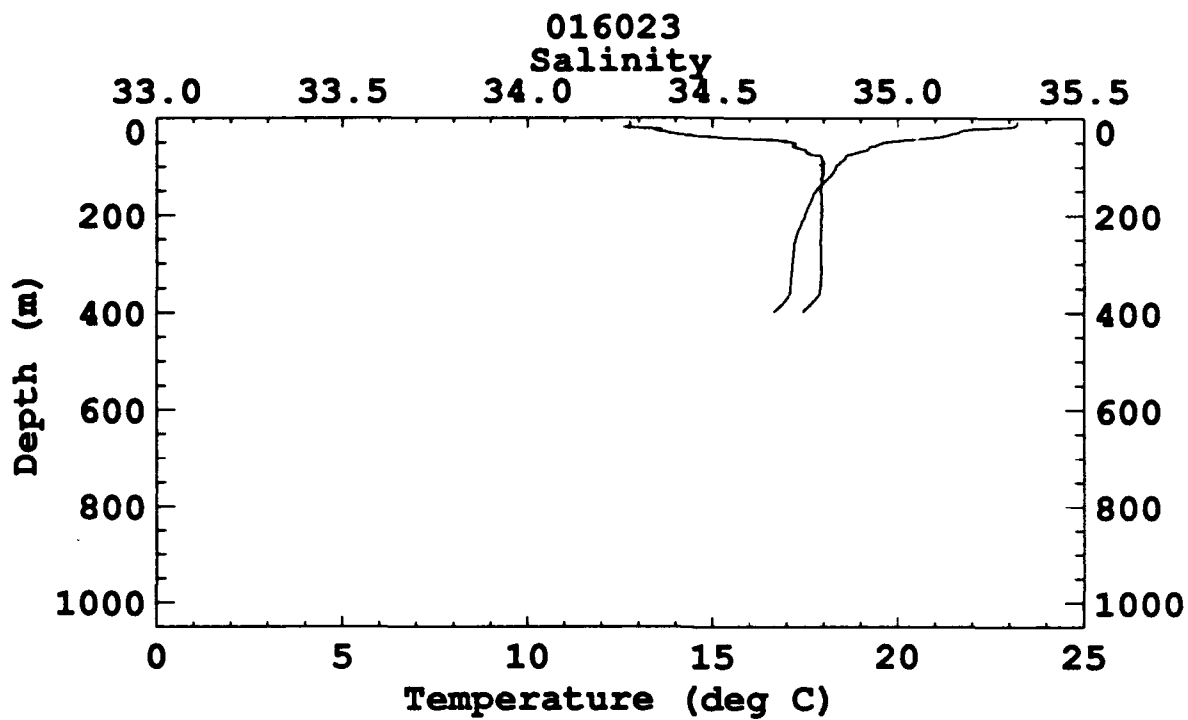


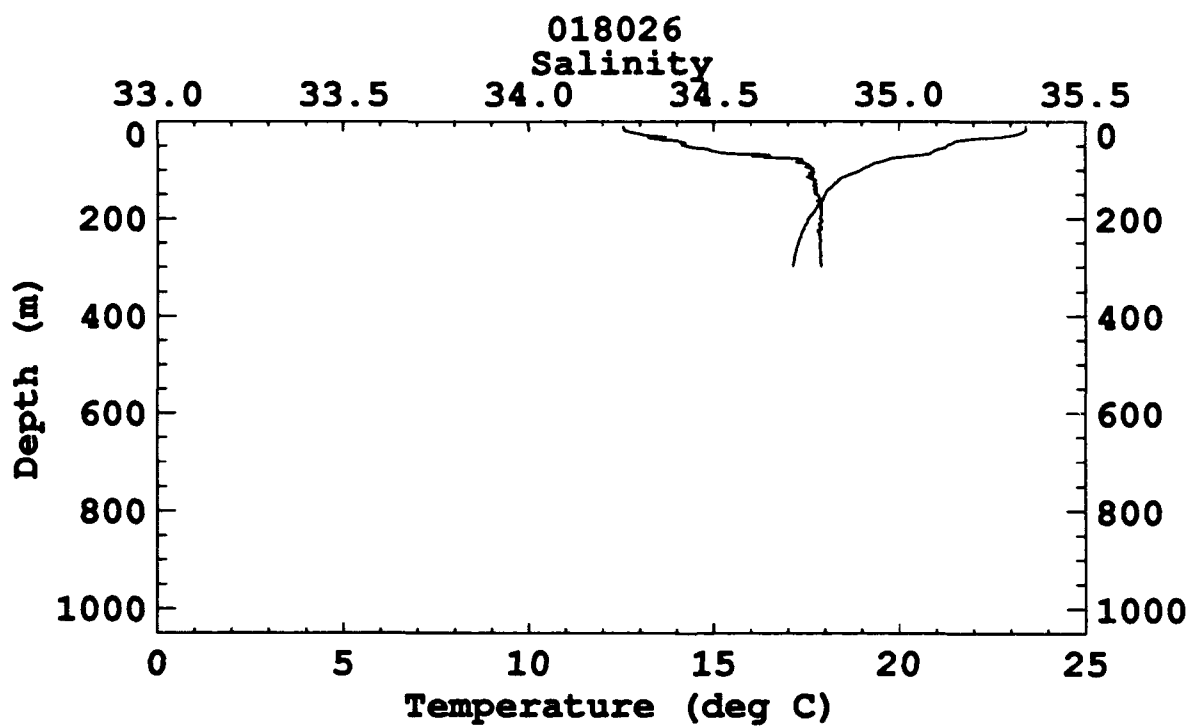
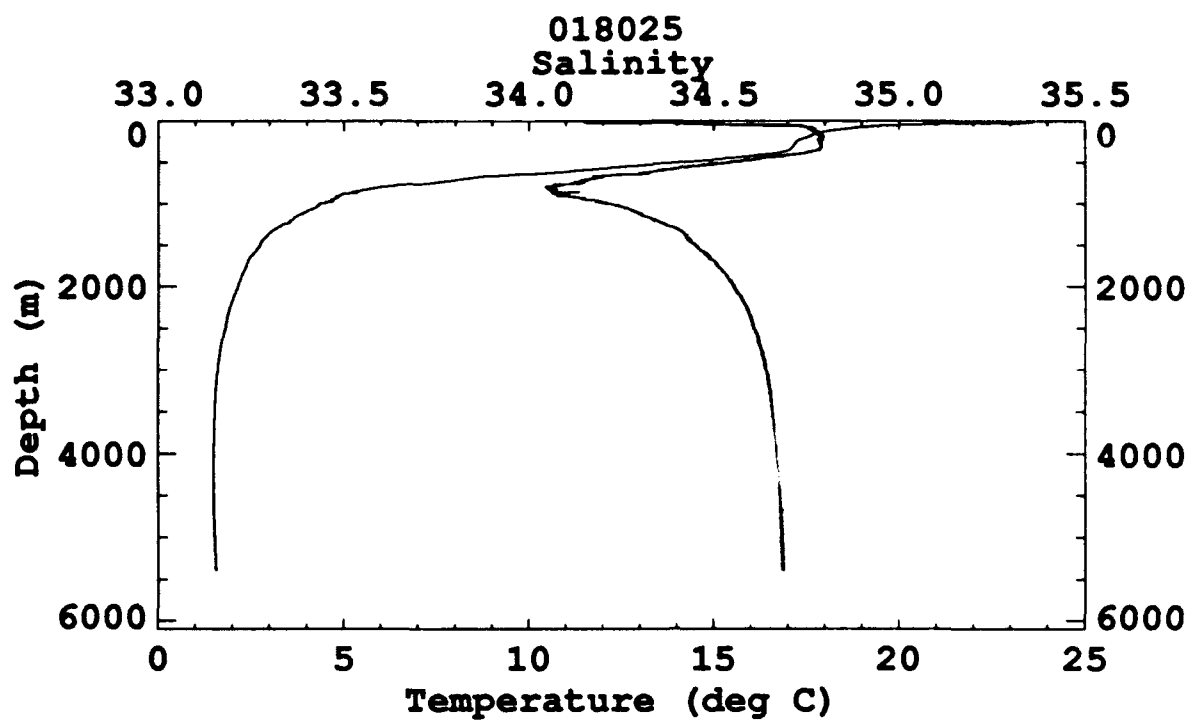


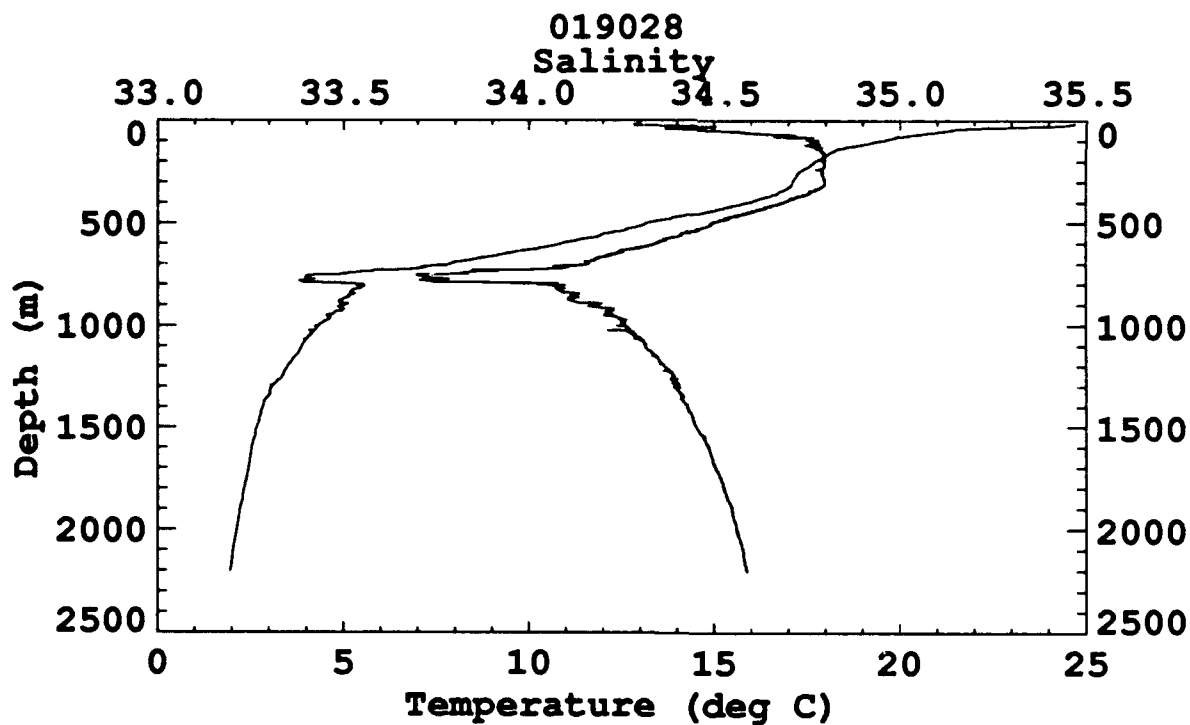
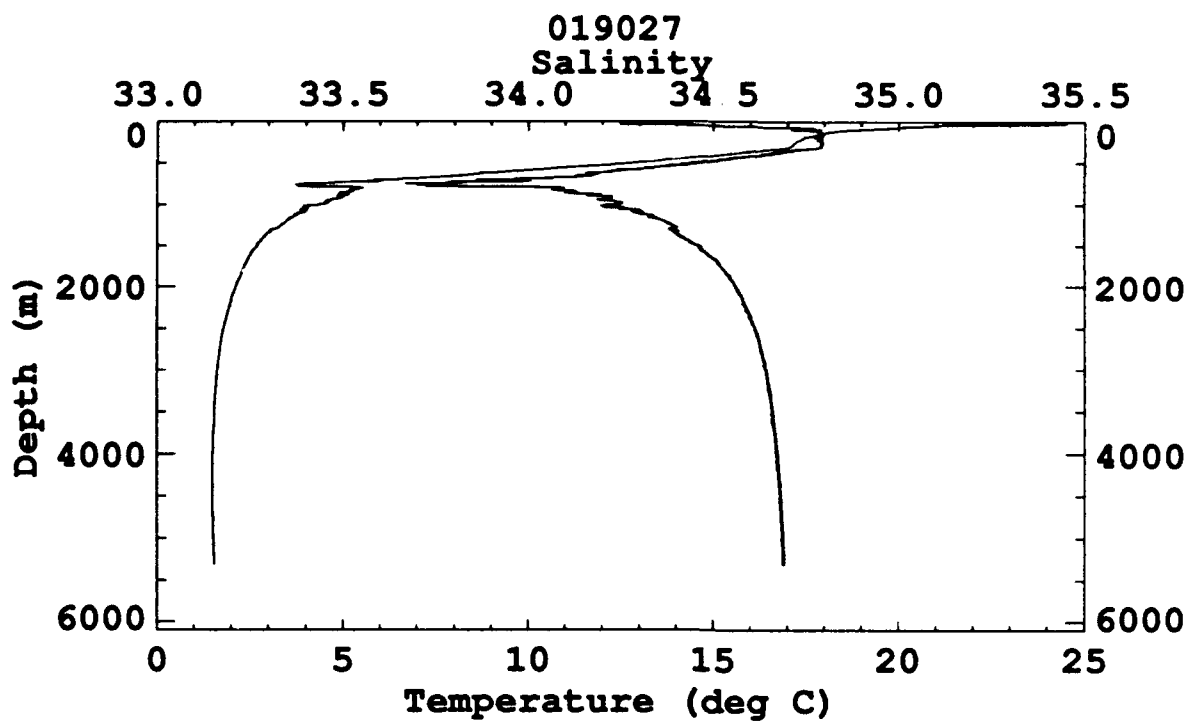


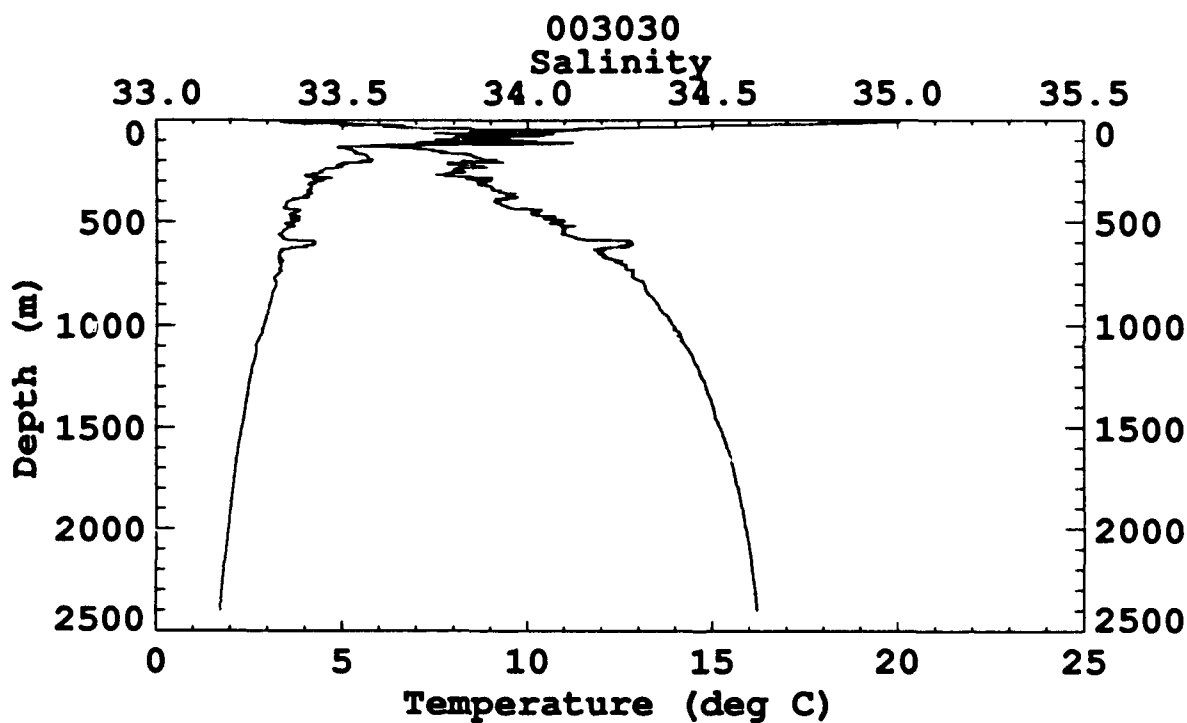
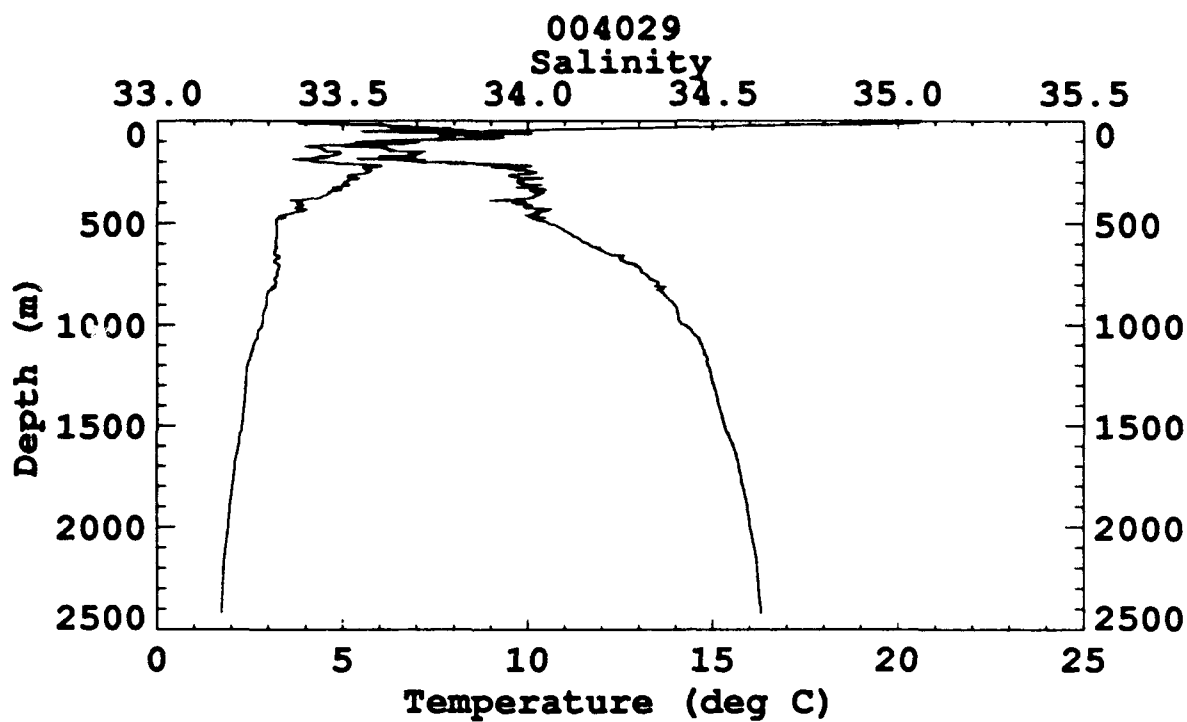




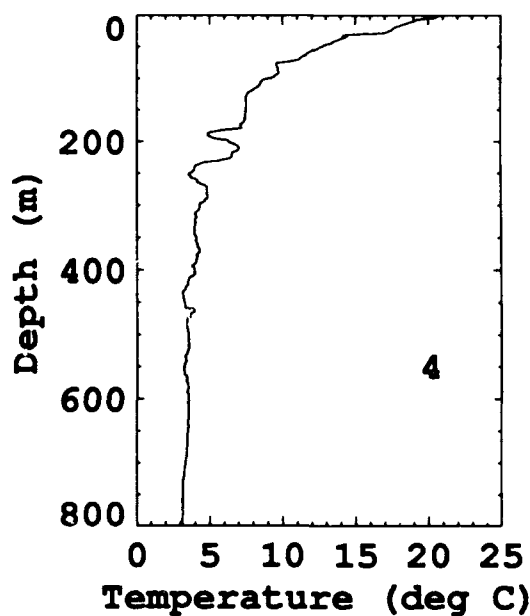
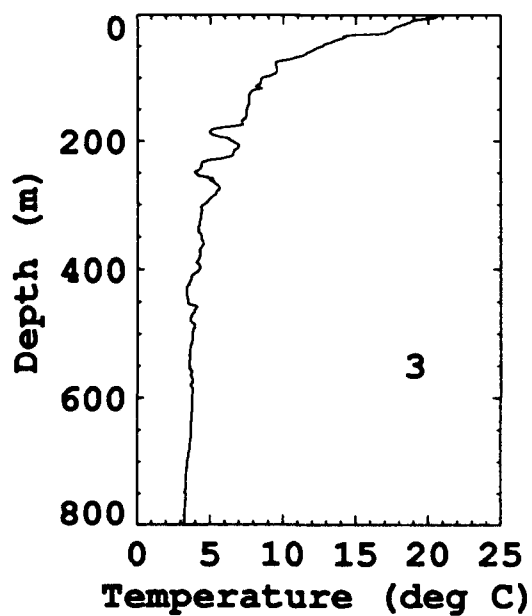
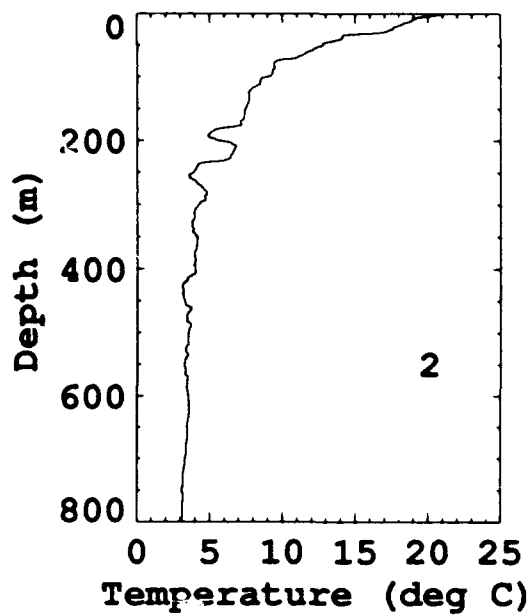
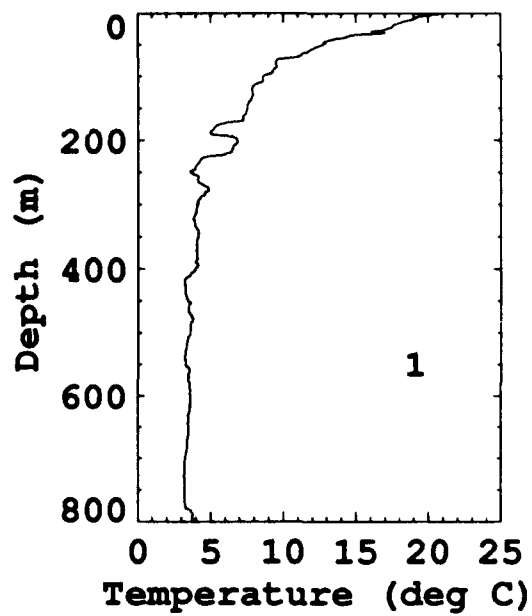


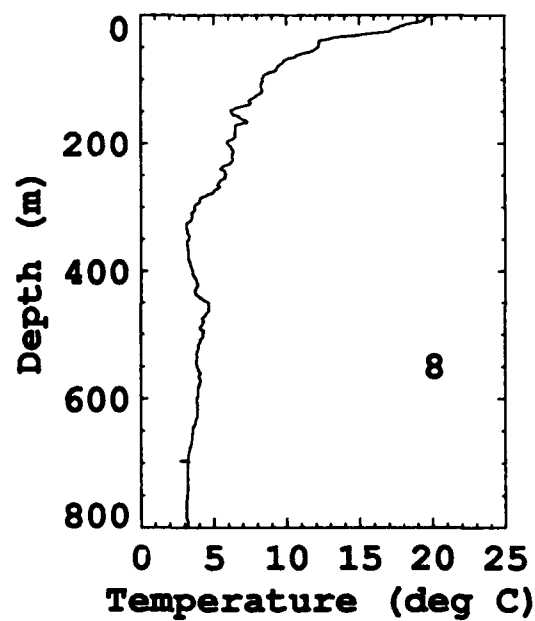
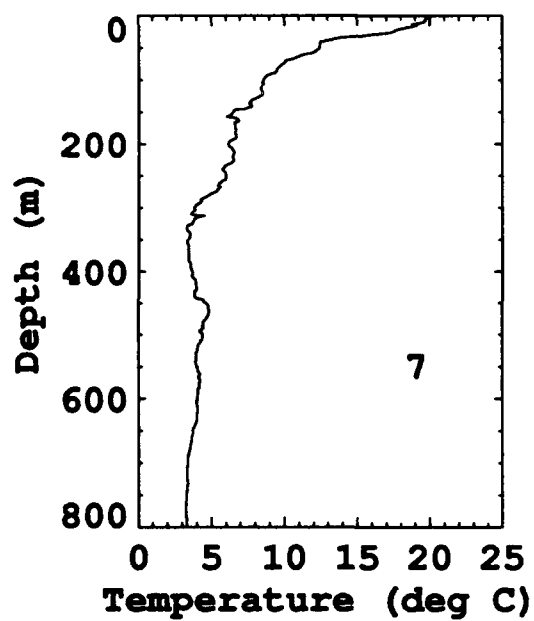
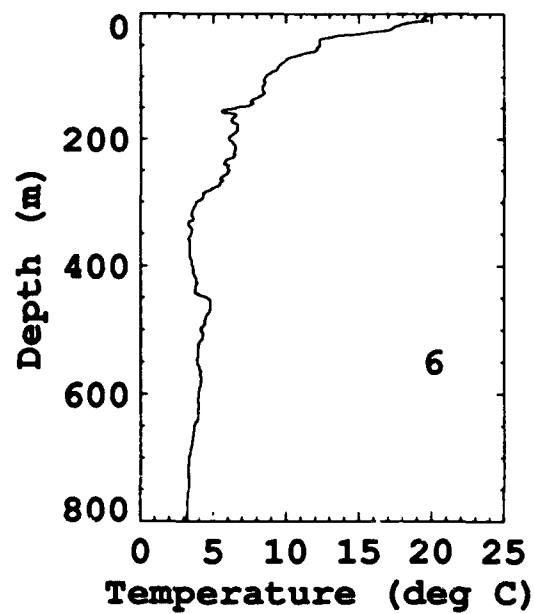
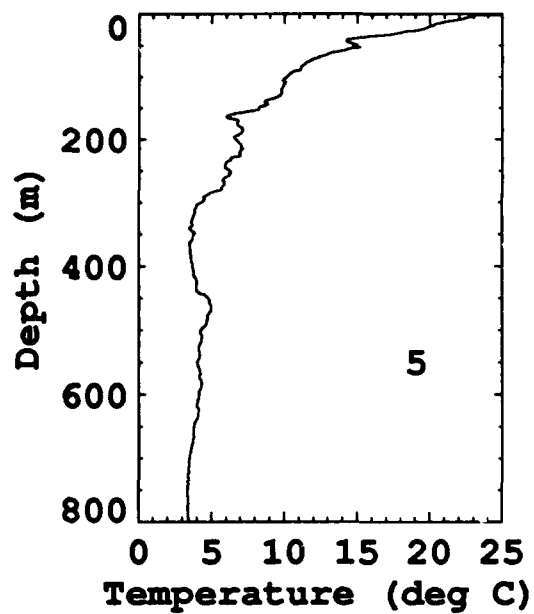


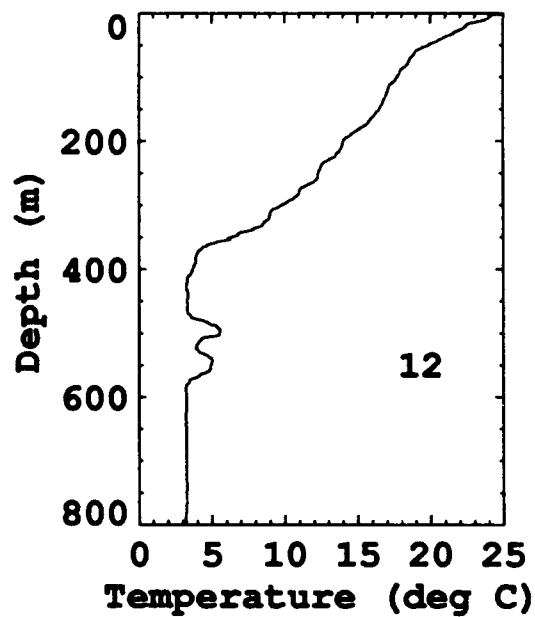
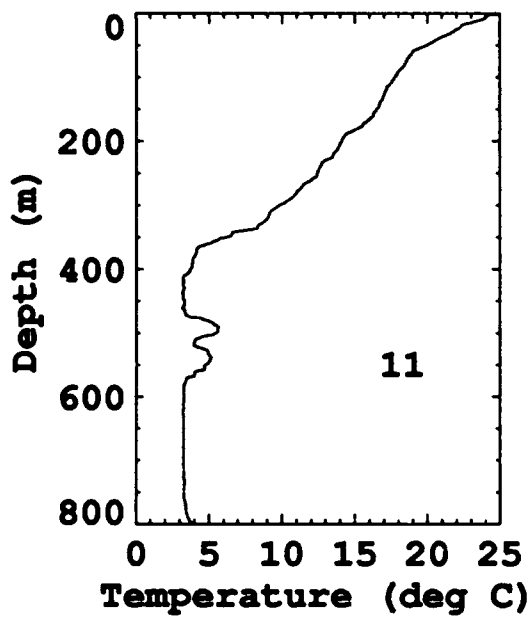
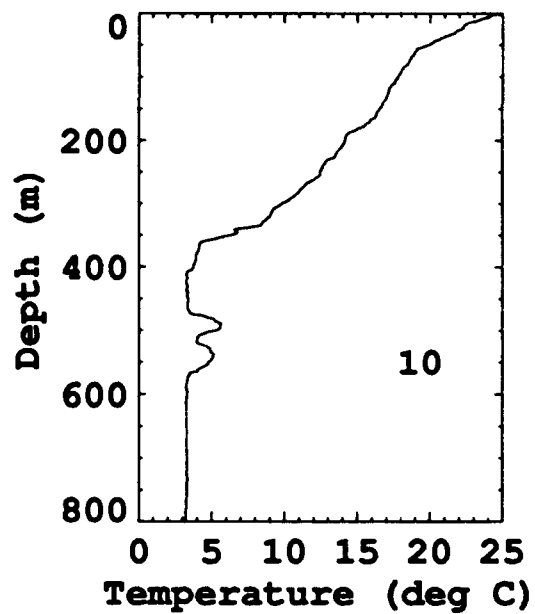
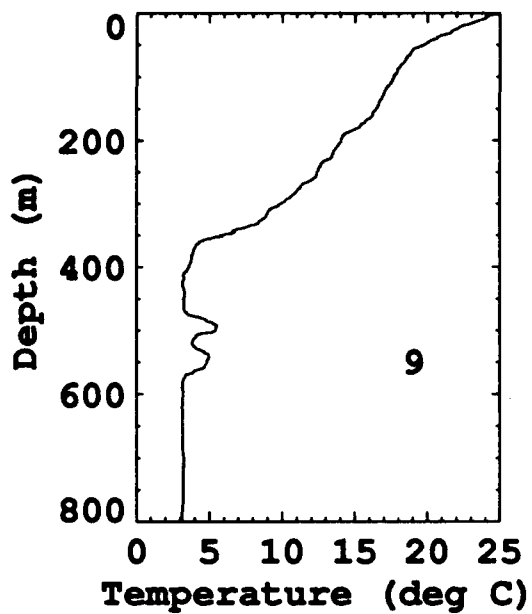


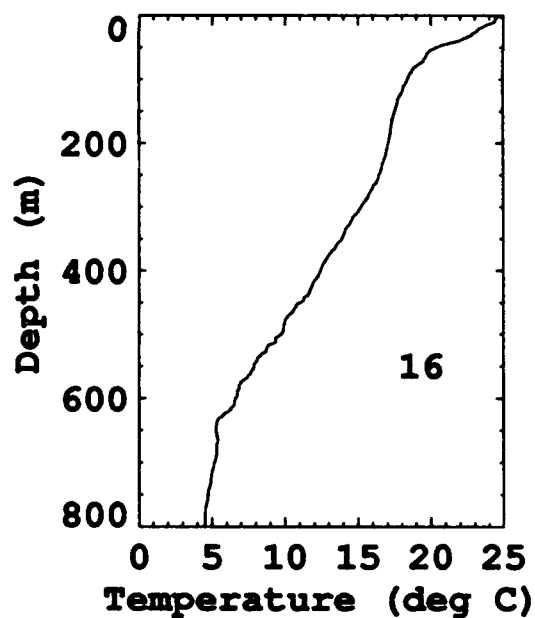
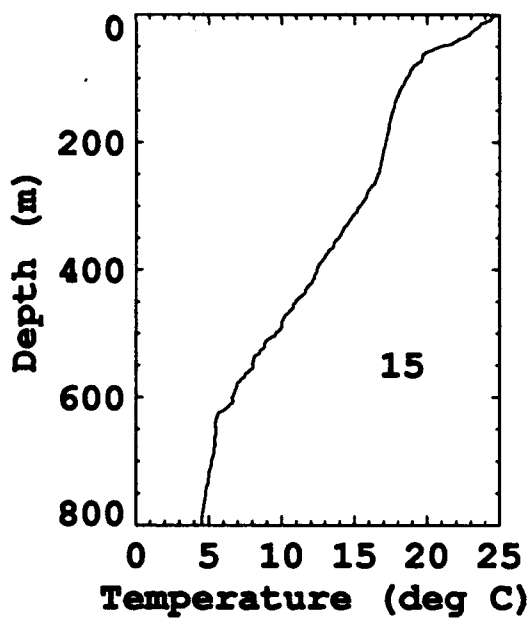
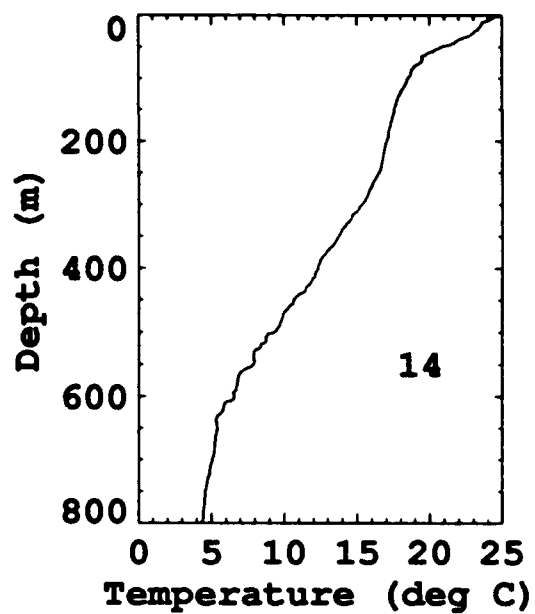
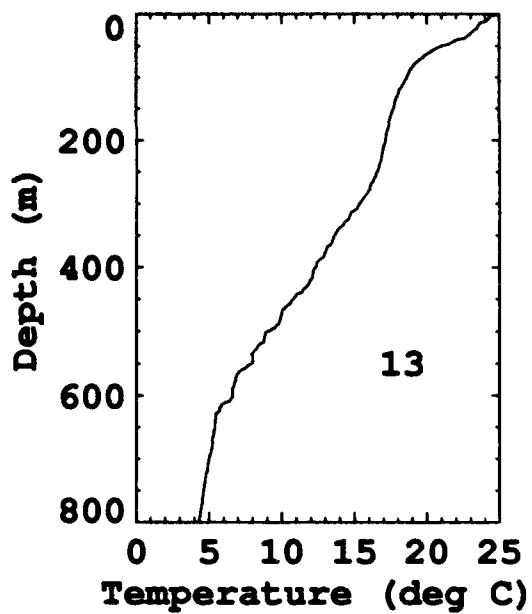


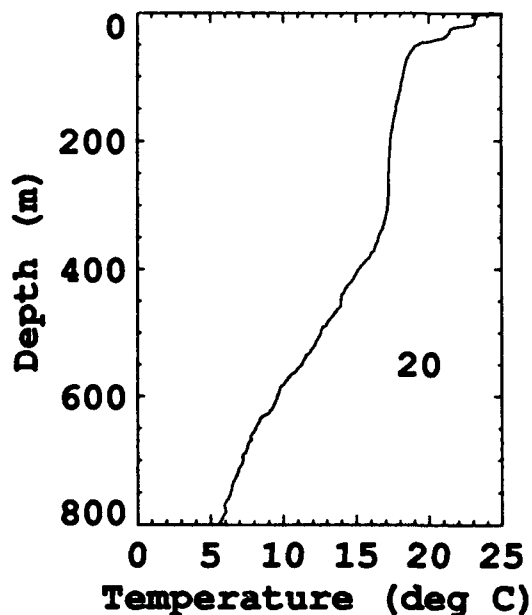
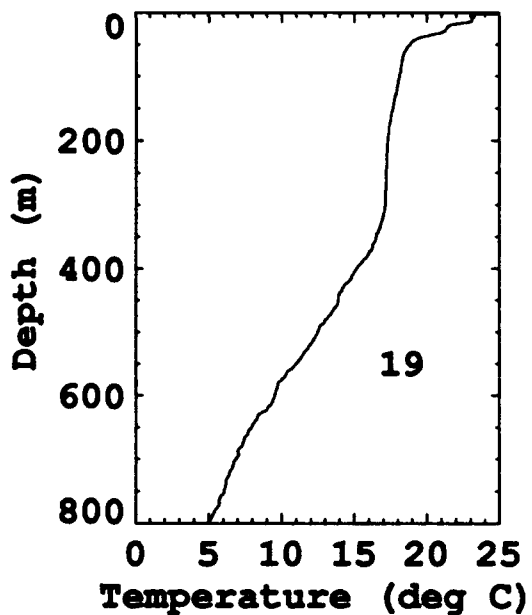
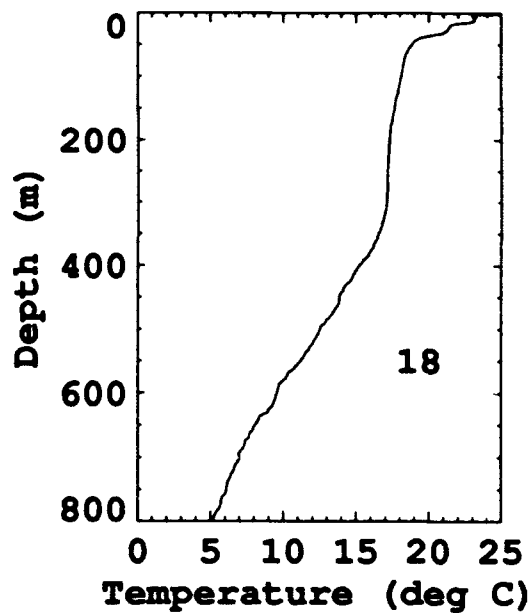
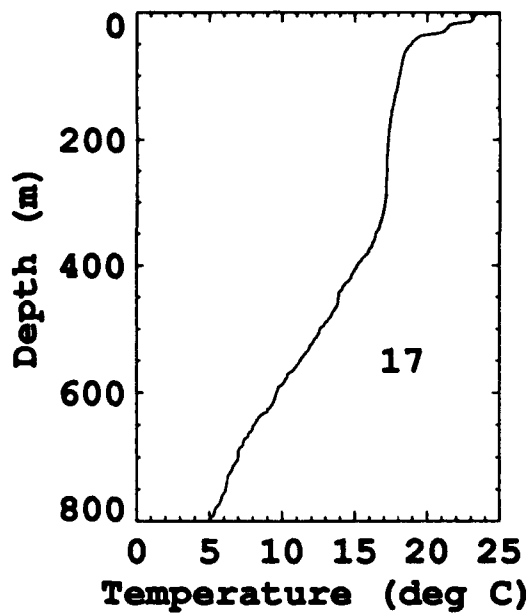
XBT PROFILES

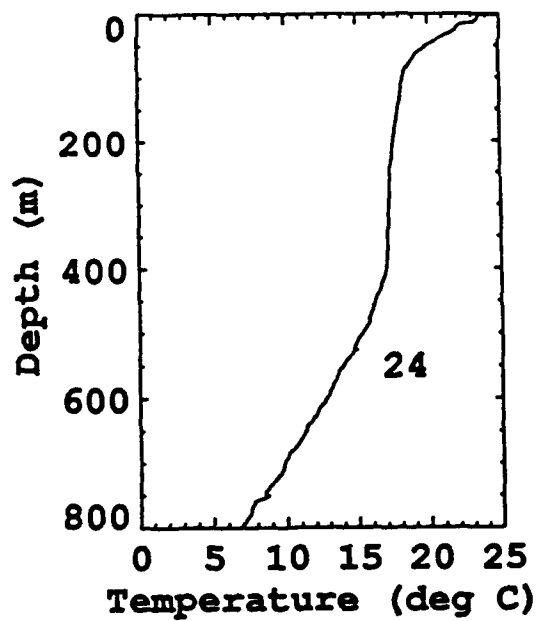
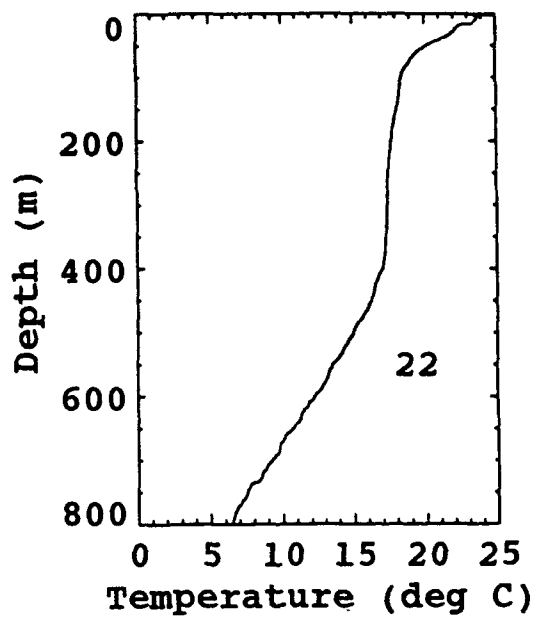
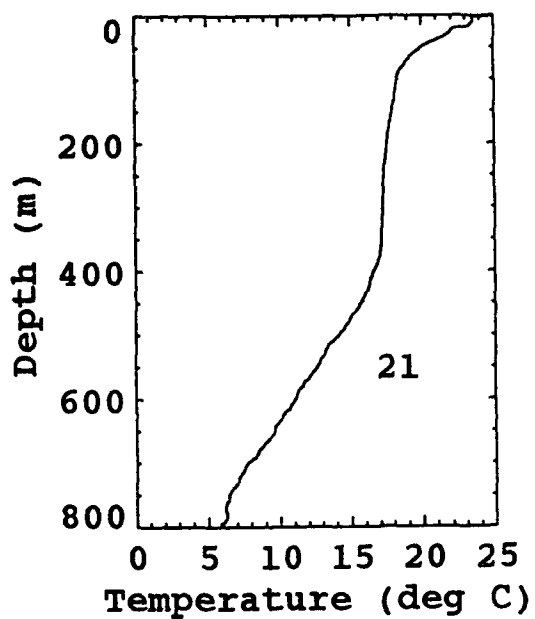


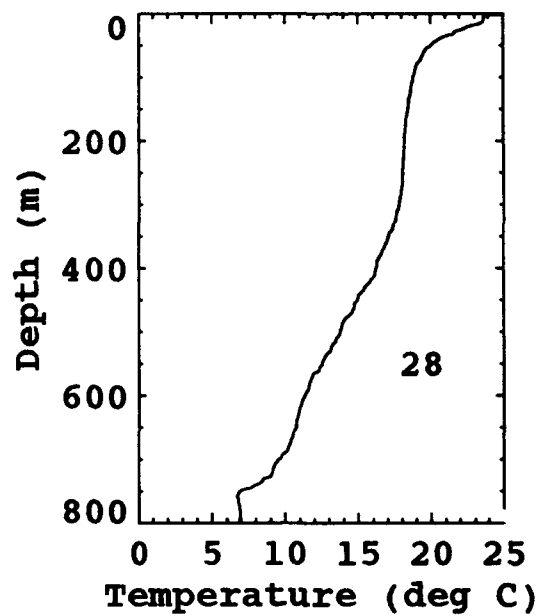
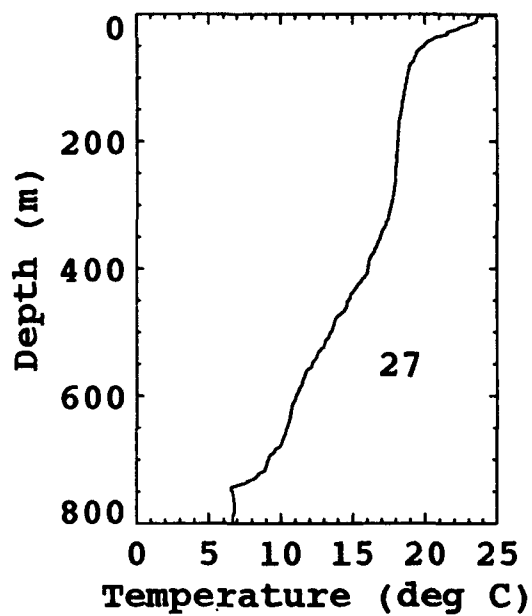
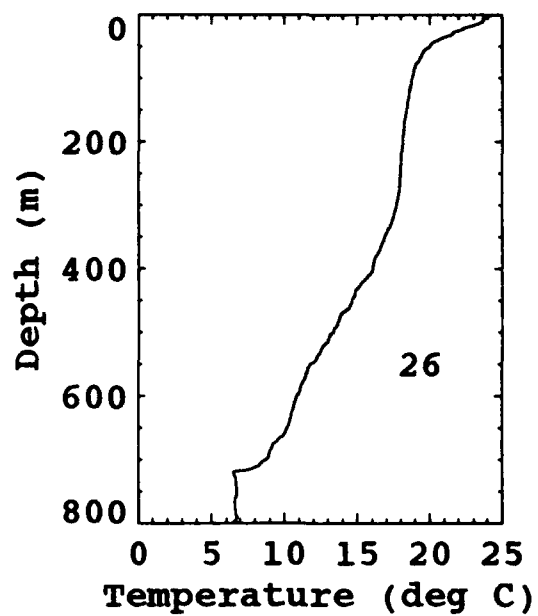
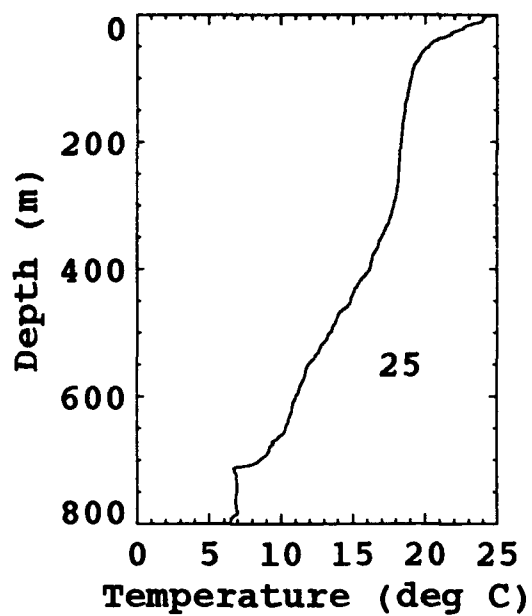


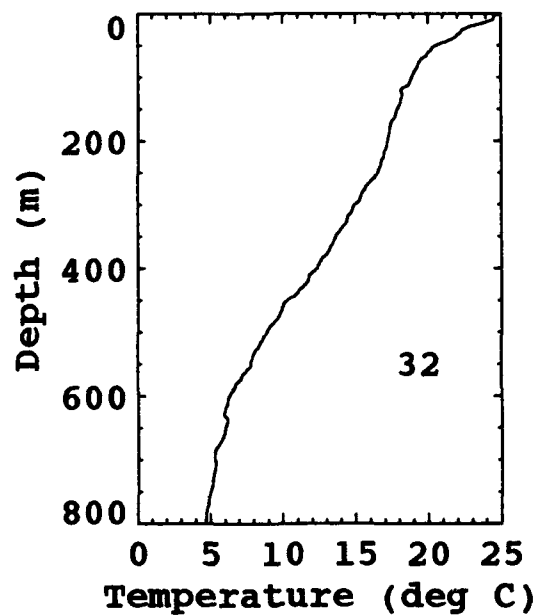
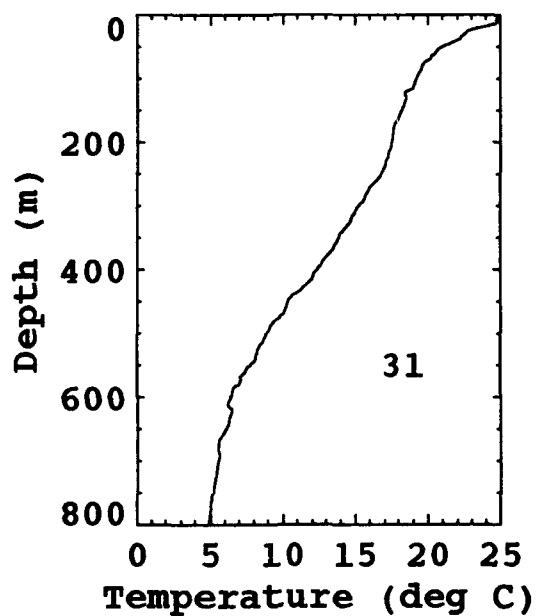
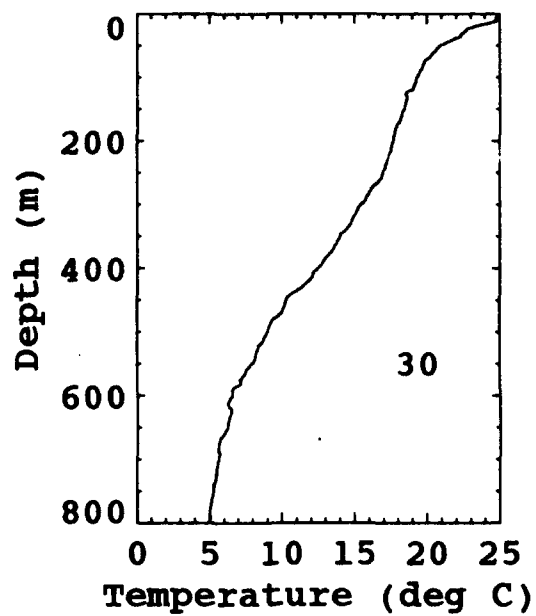
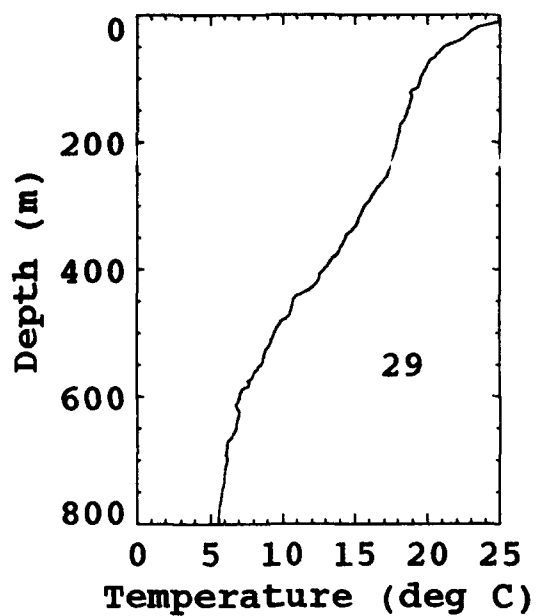


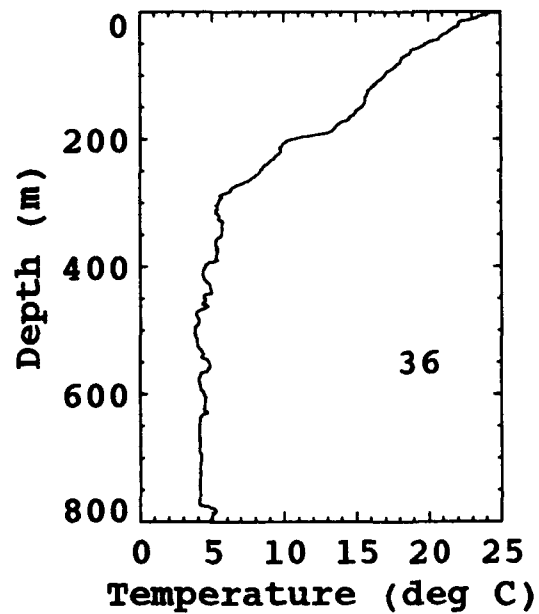
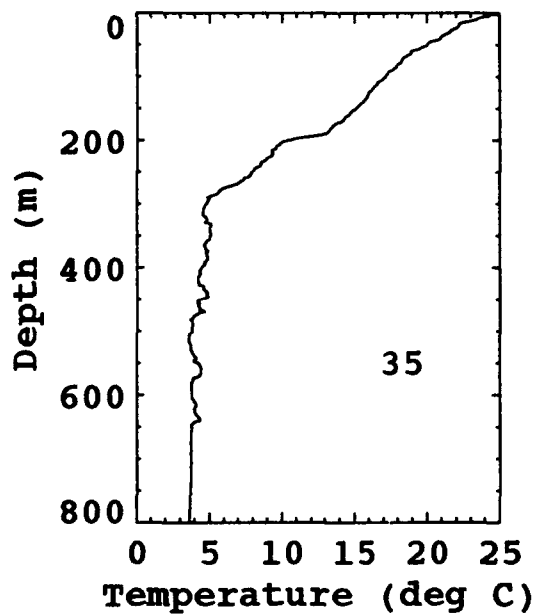
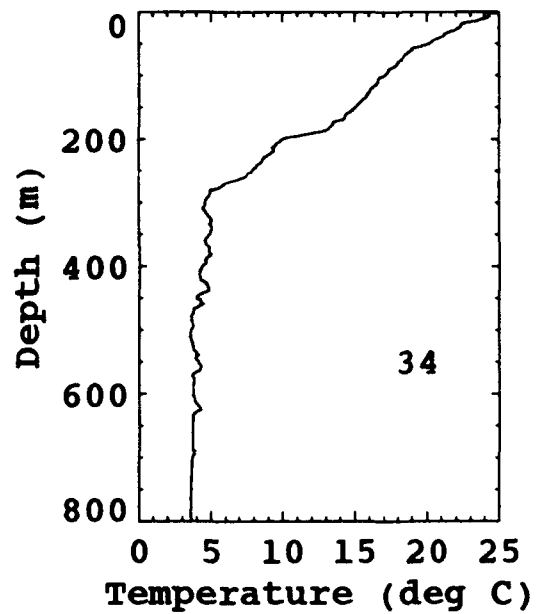
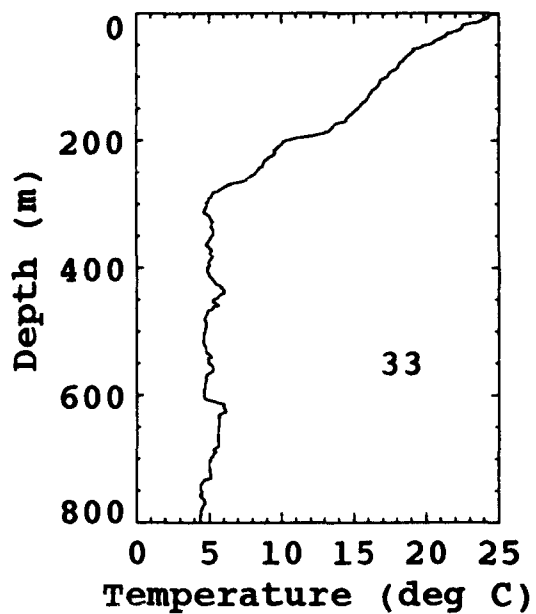


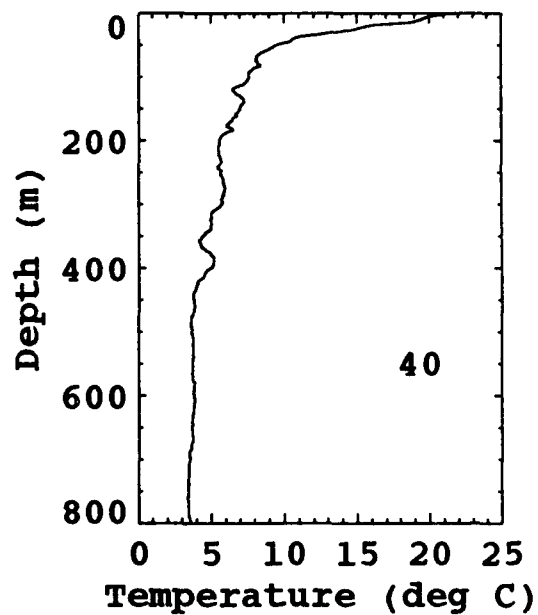
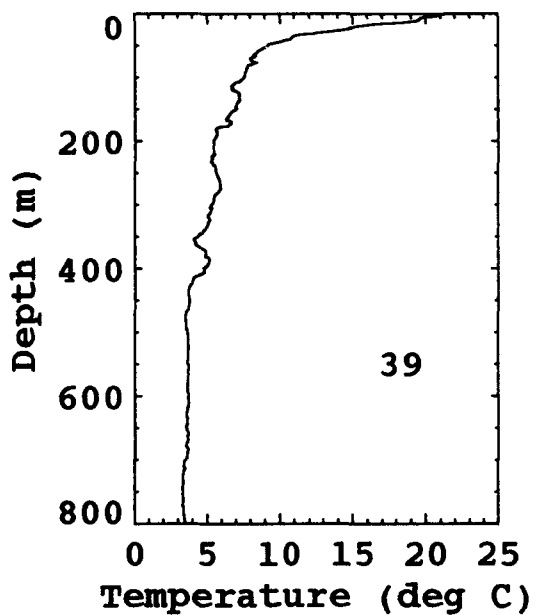
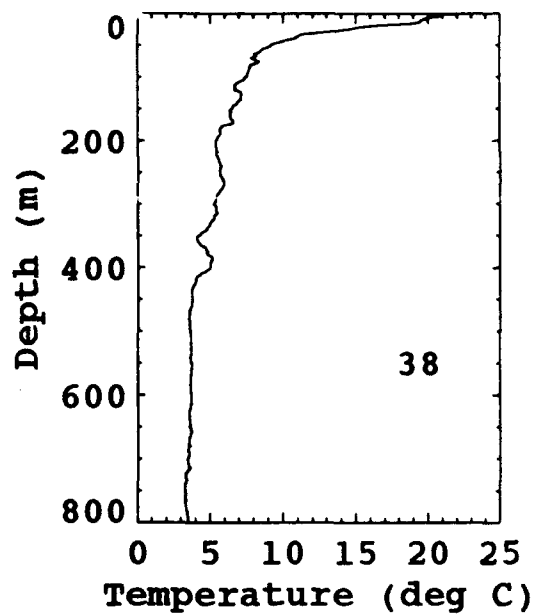
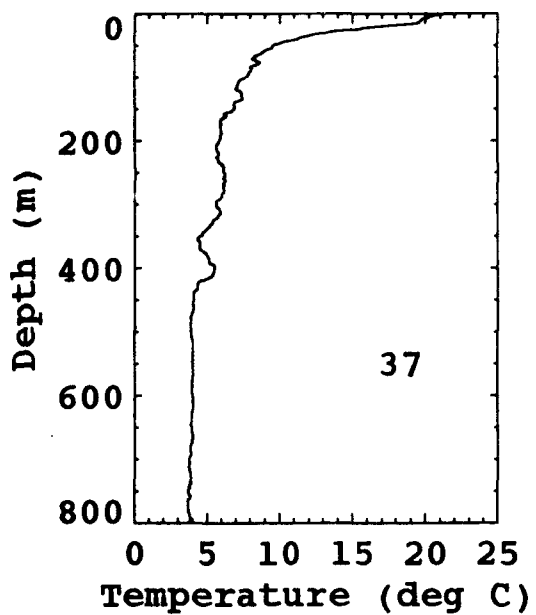






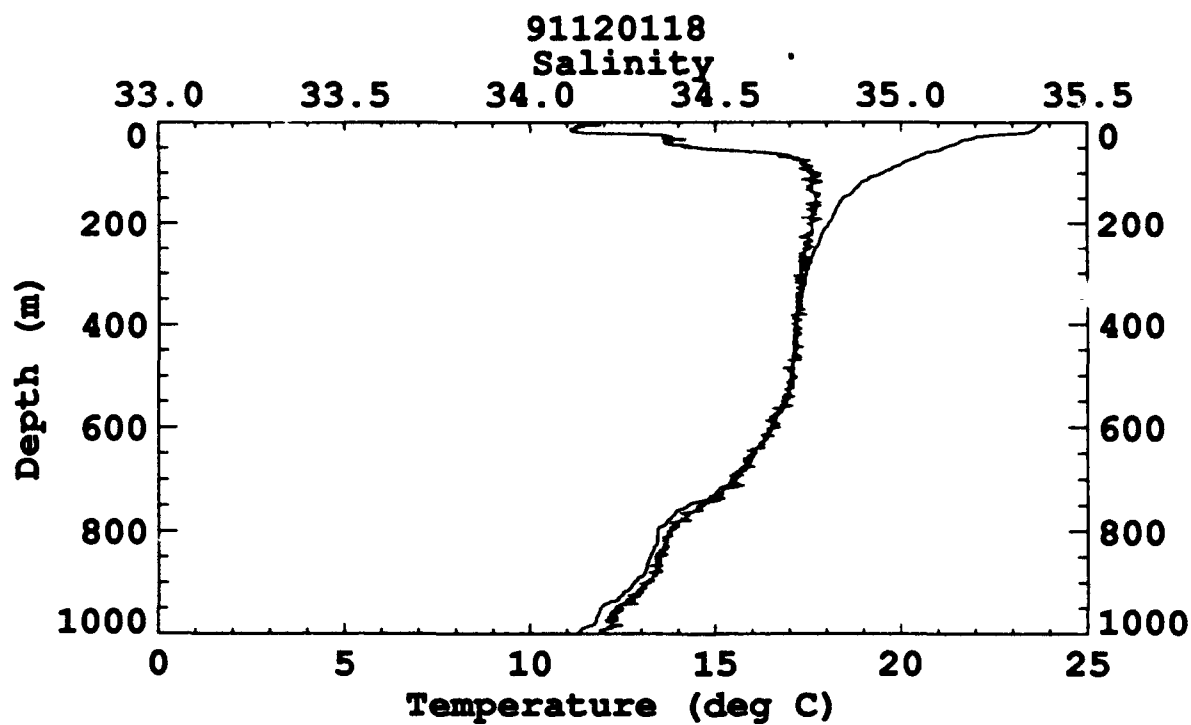
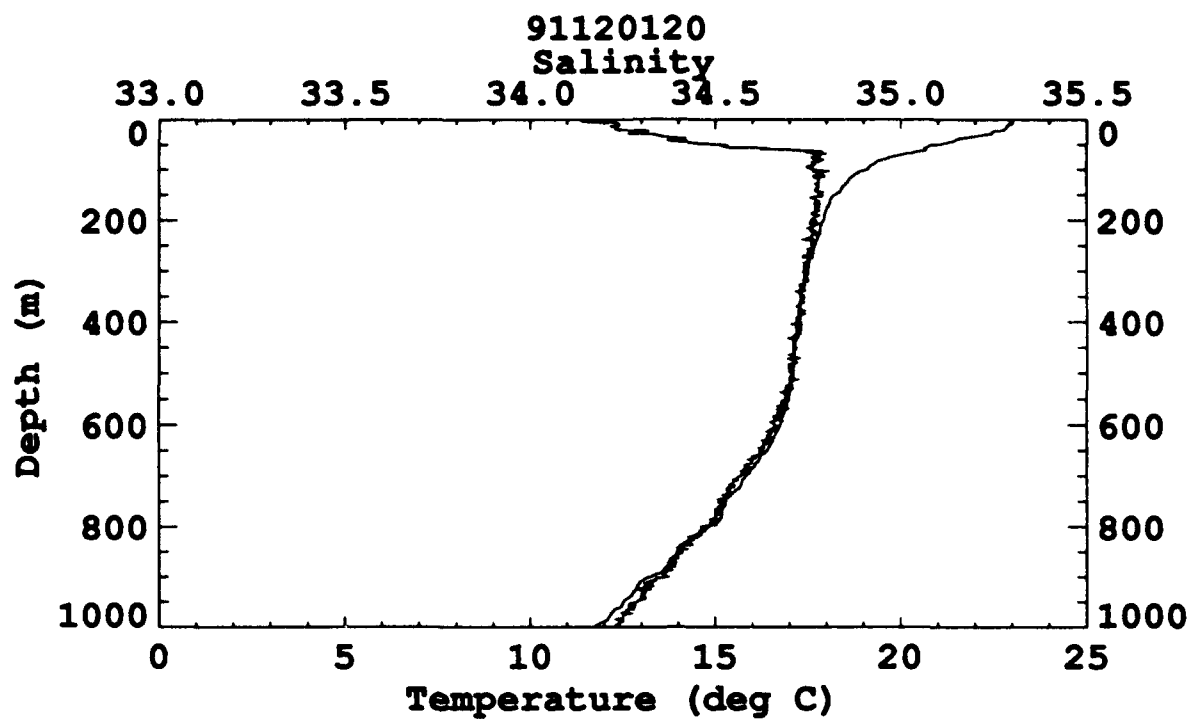


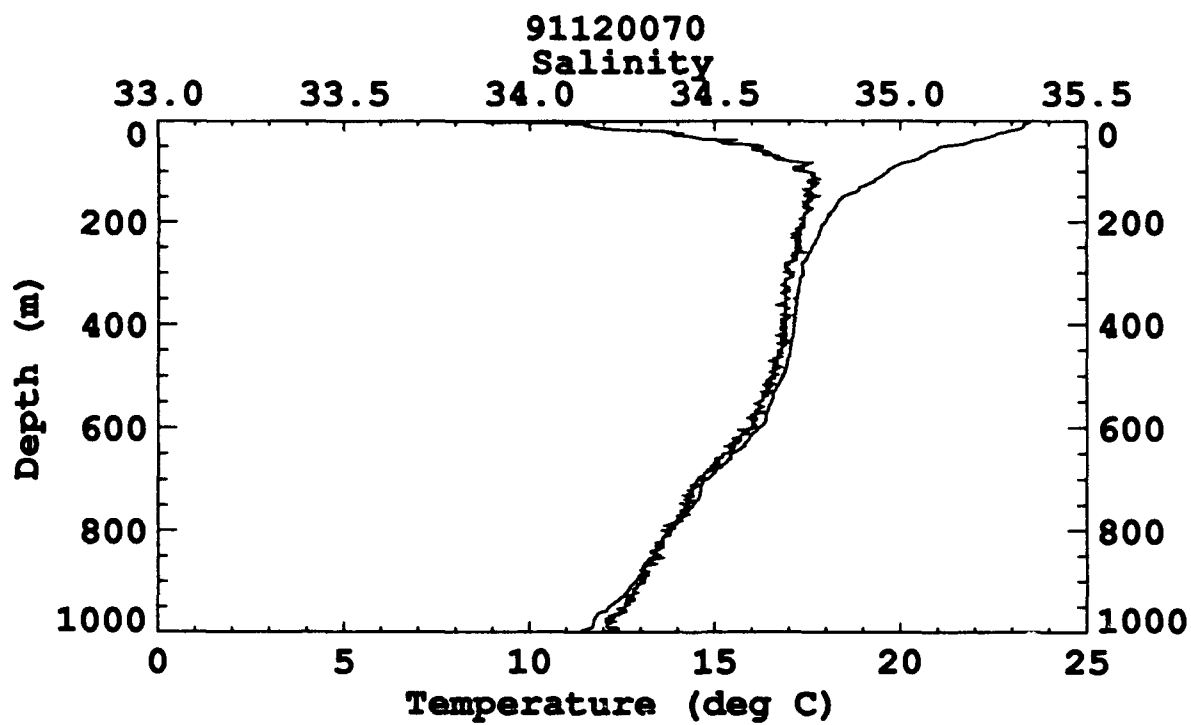
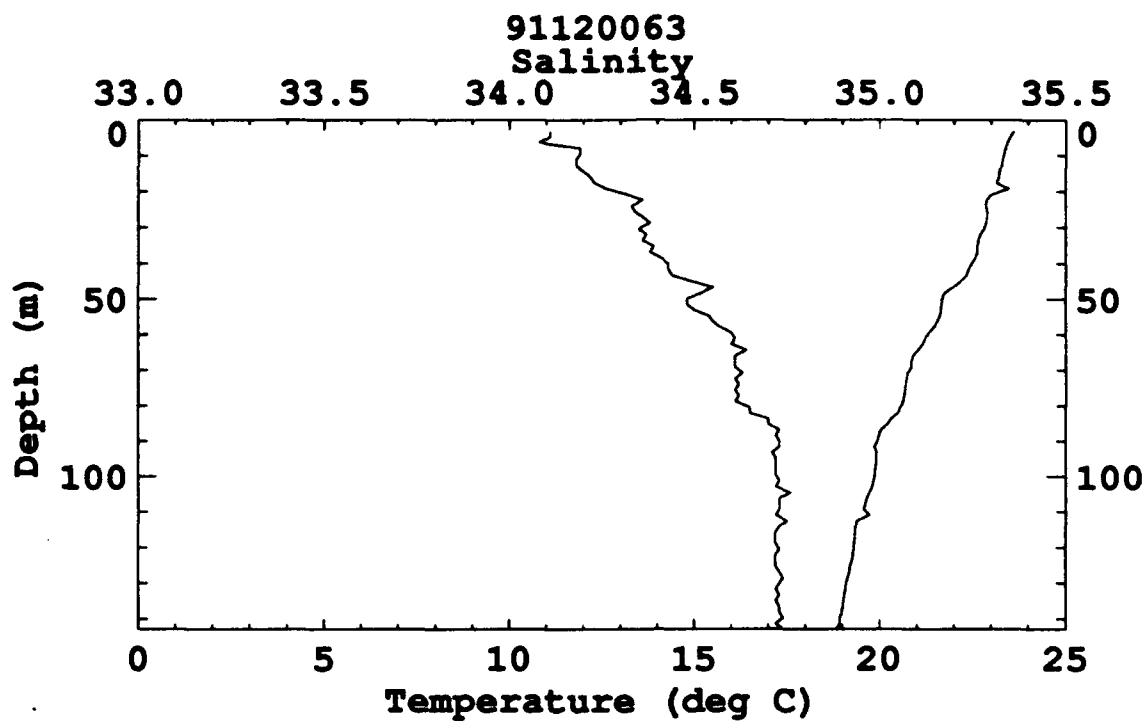


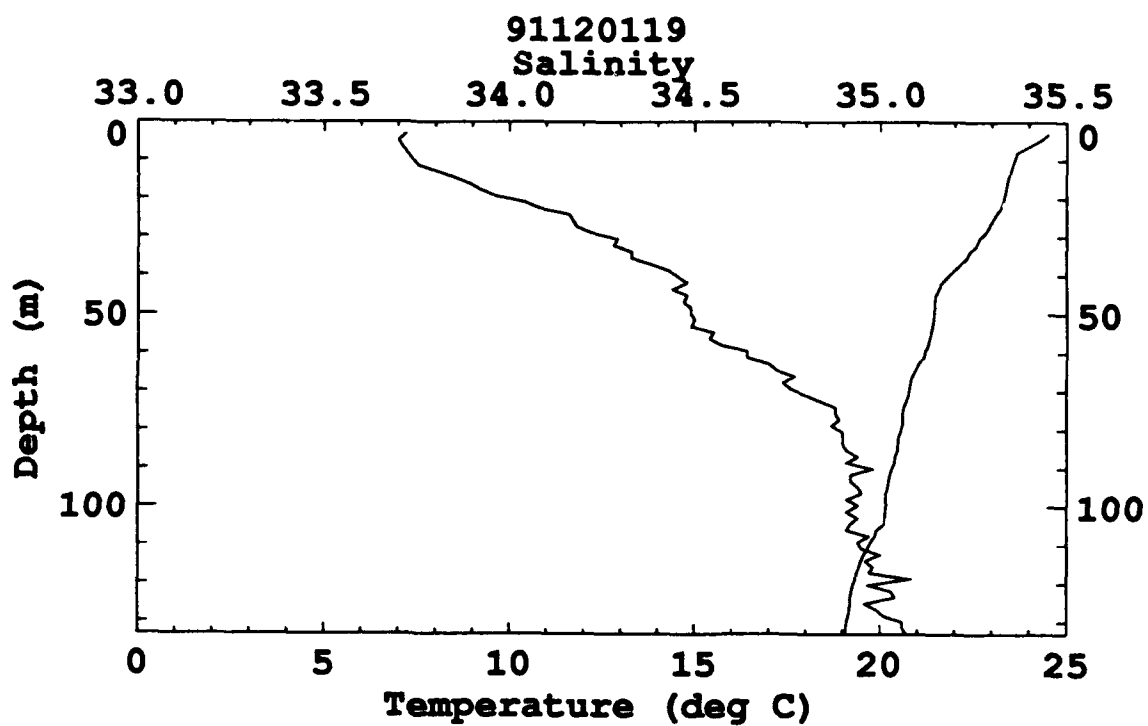
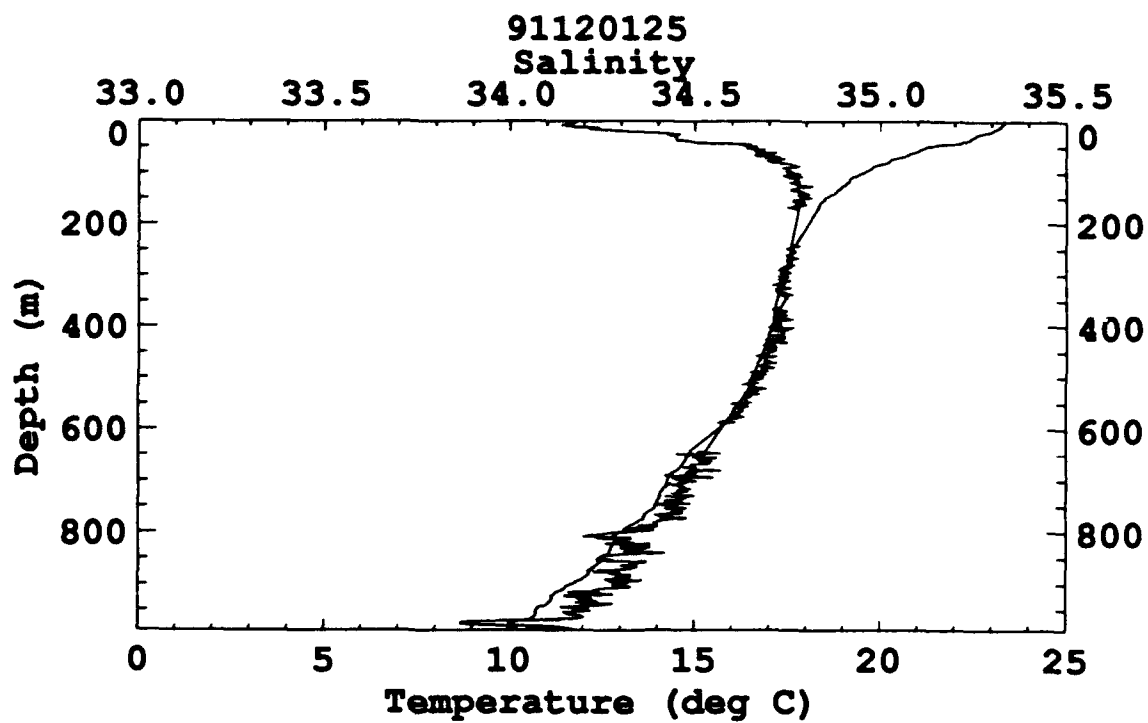


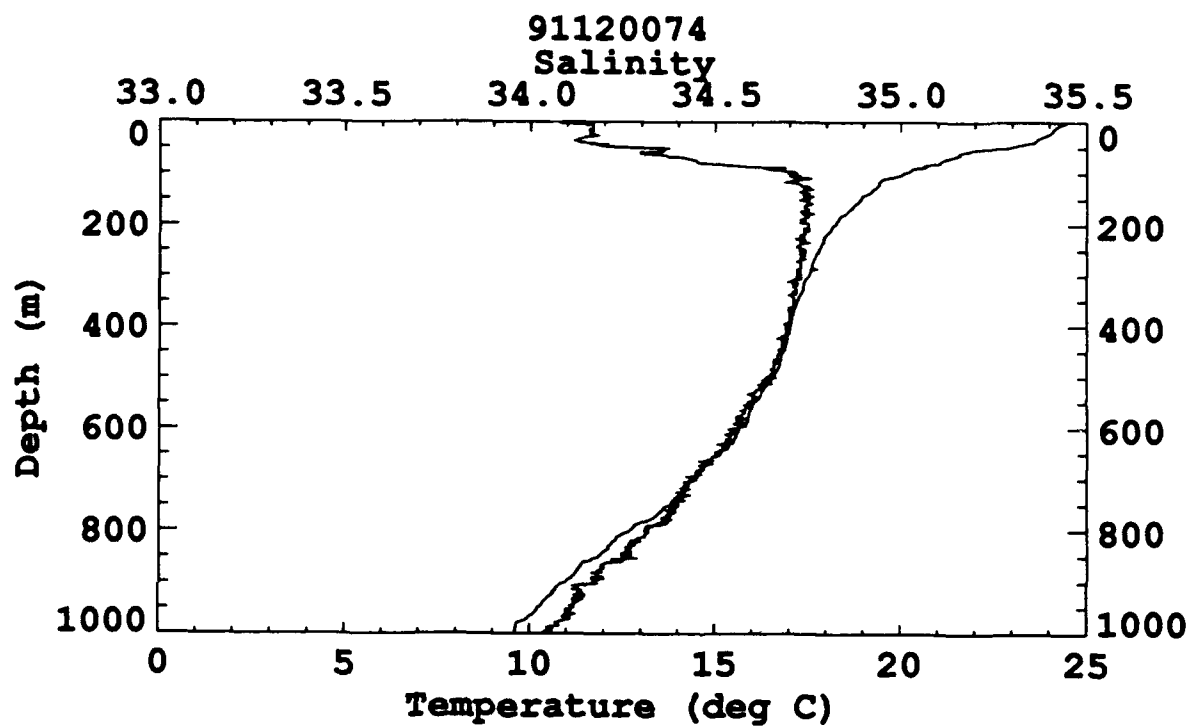
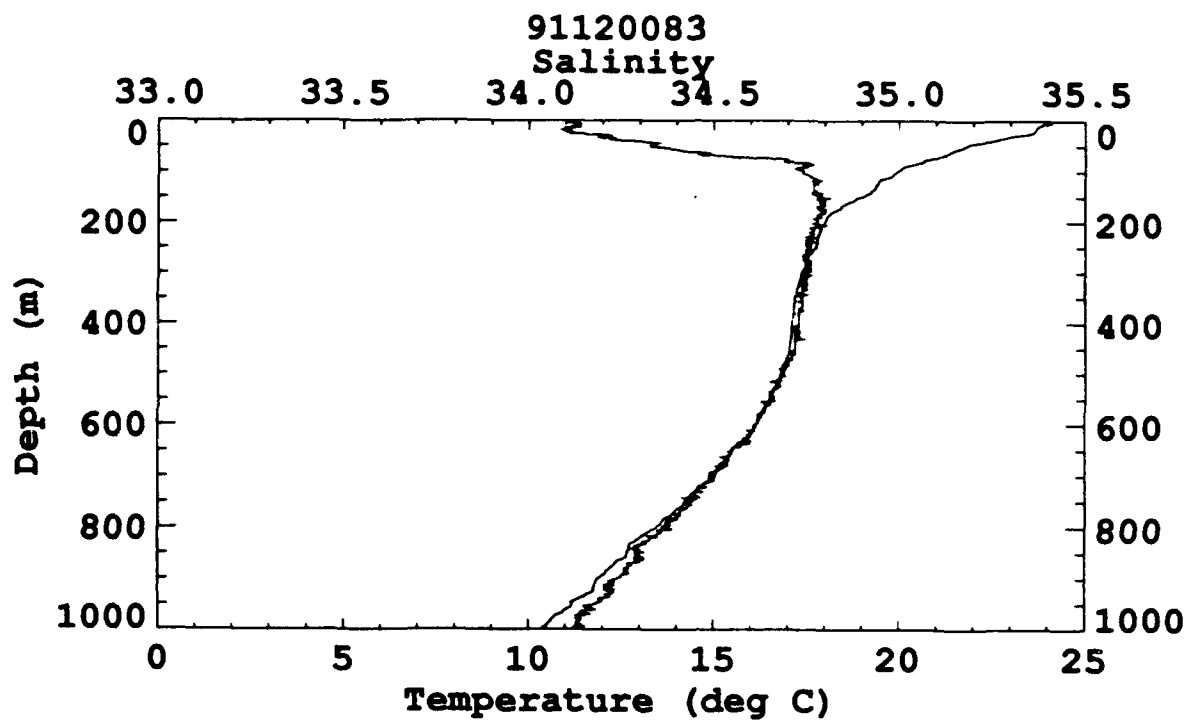


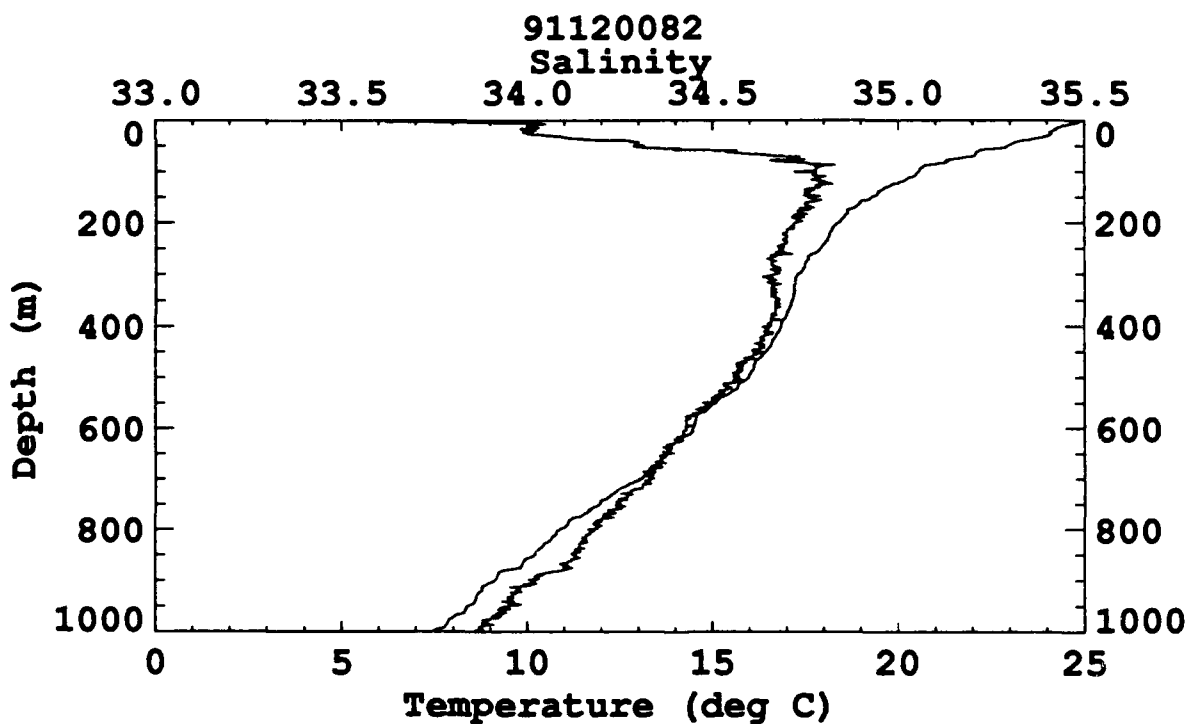
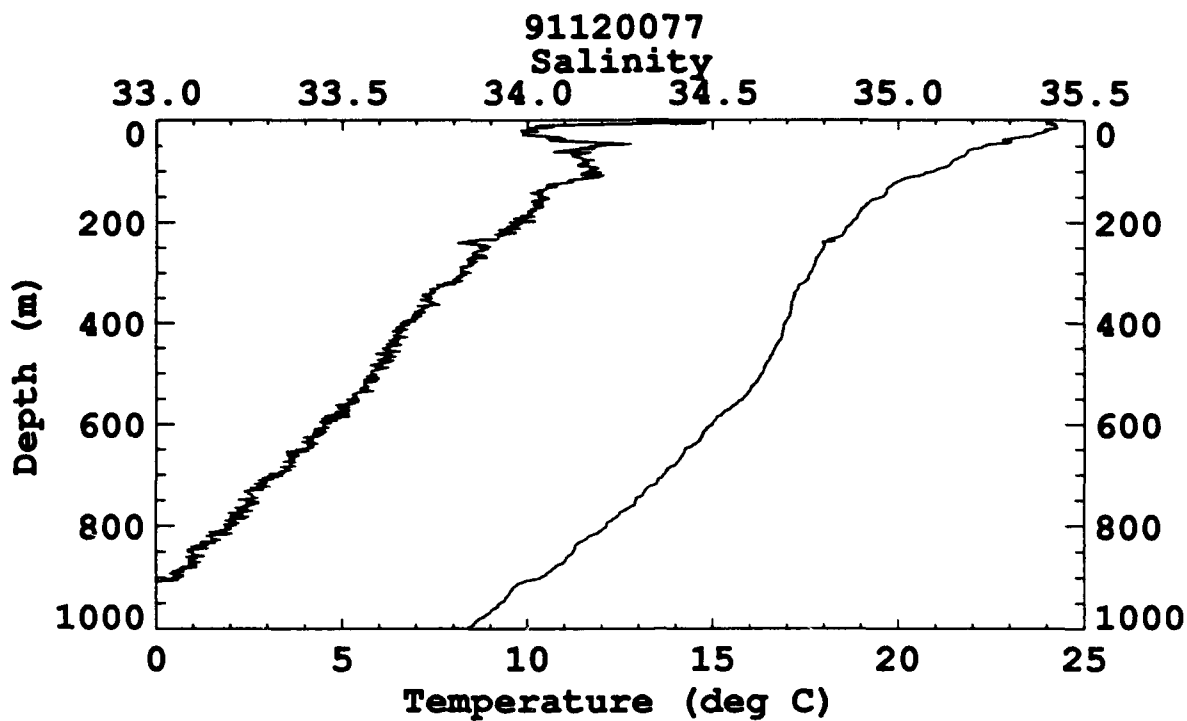
XCTD PROFILES

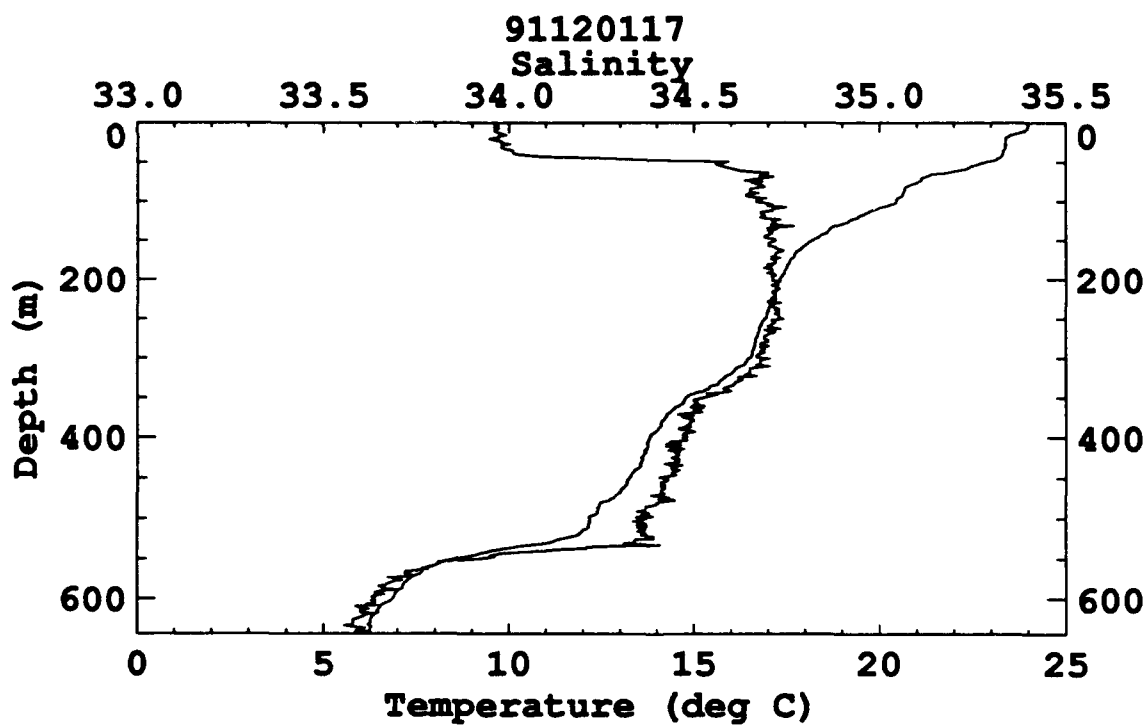
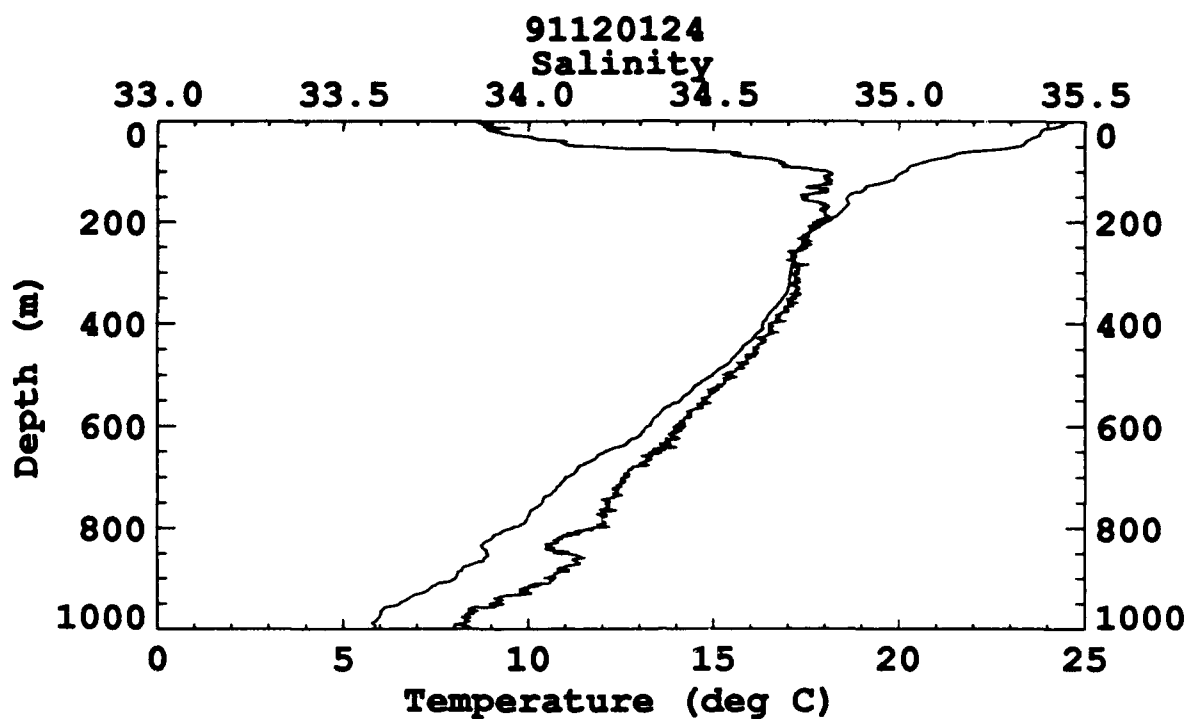


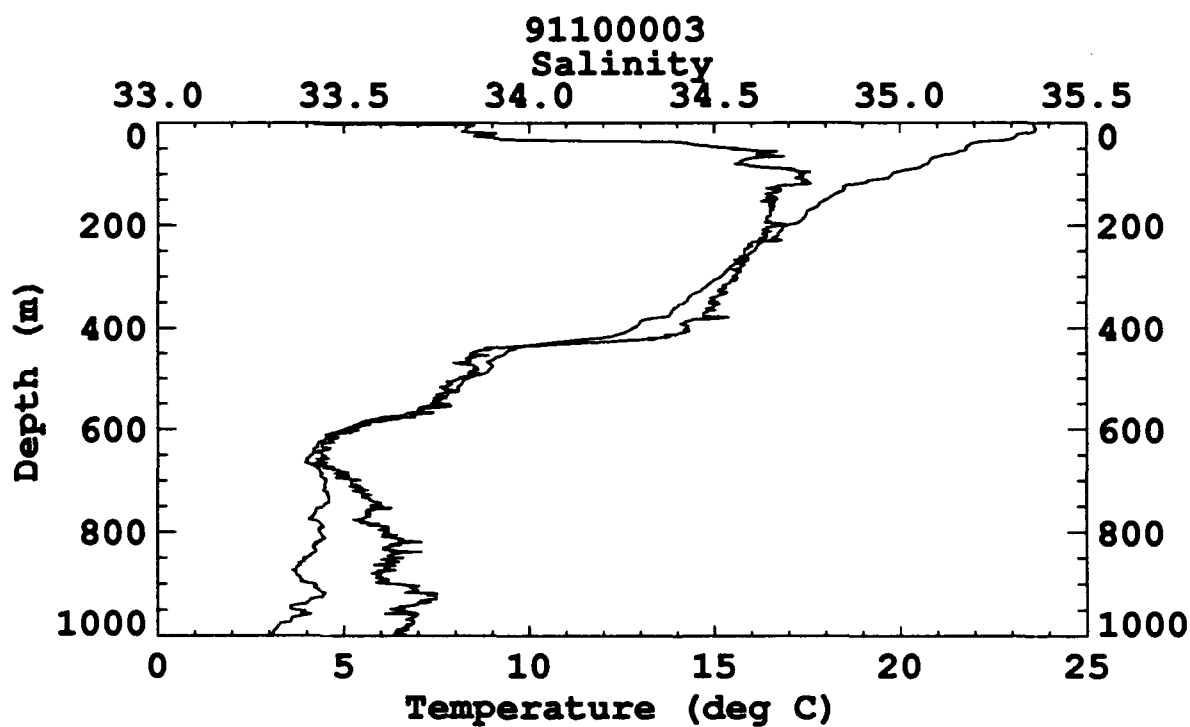
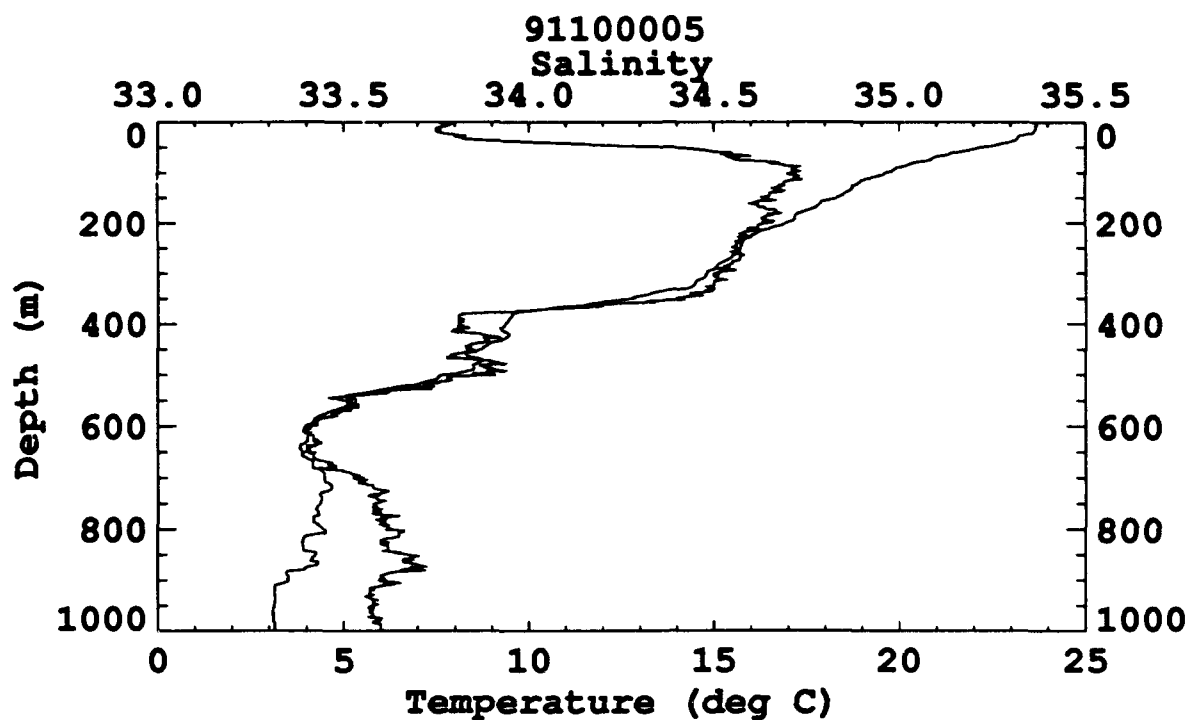


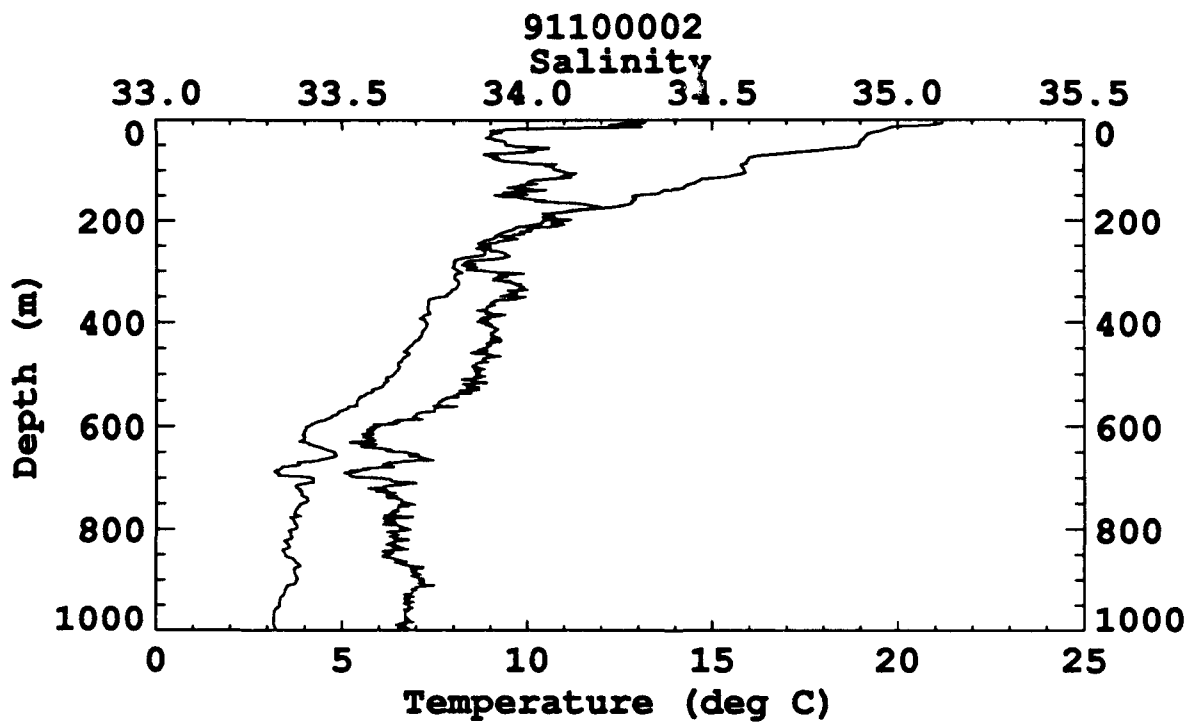
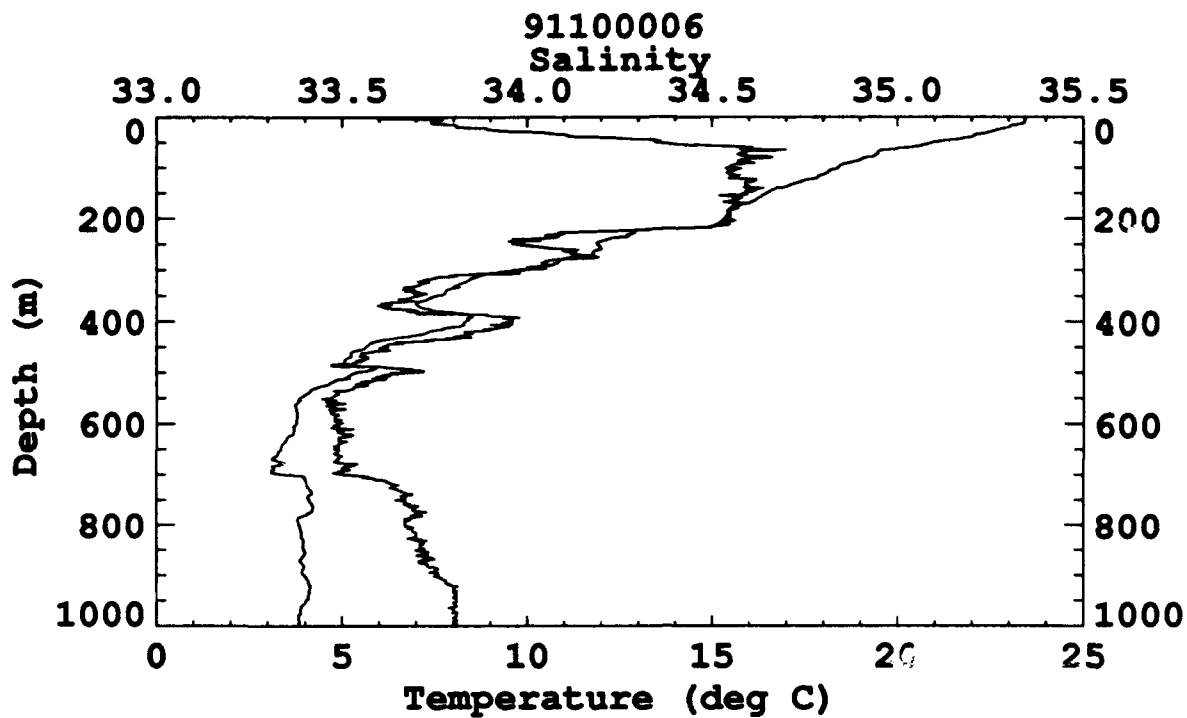


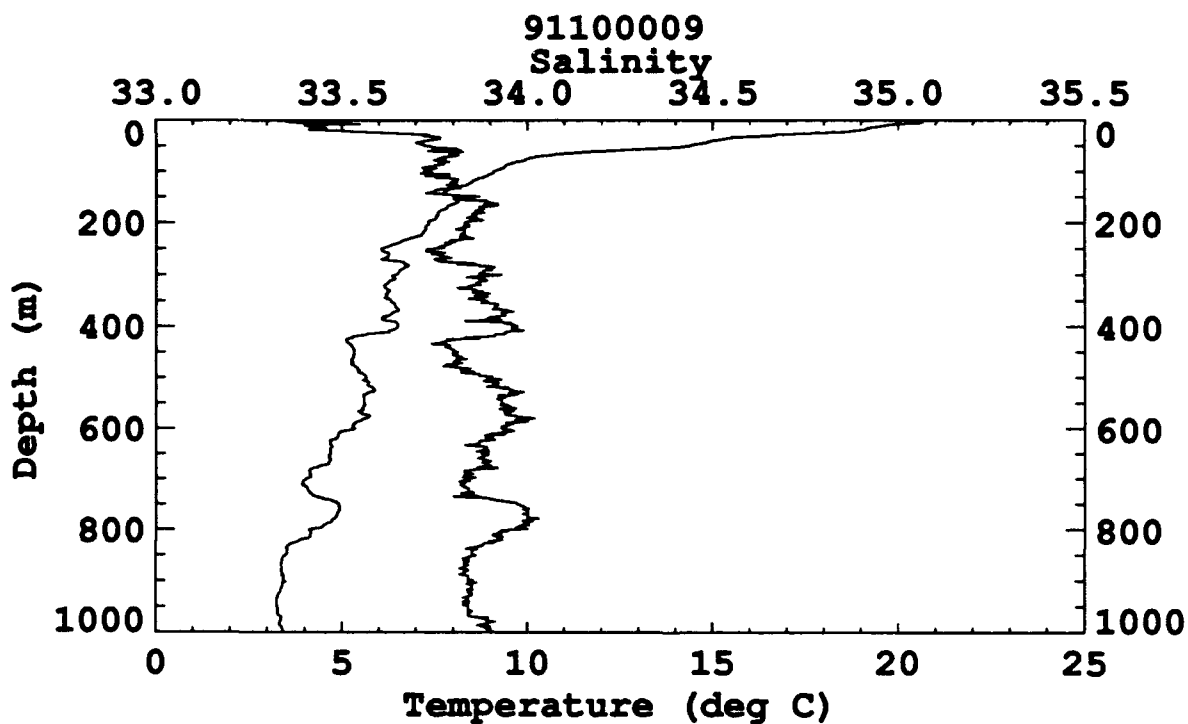
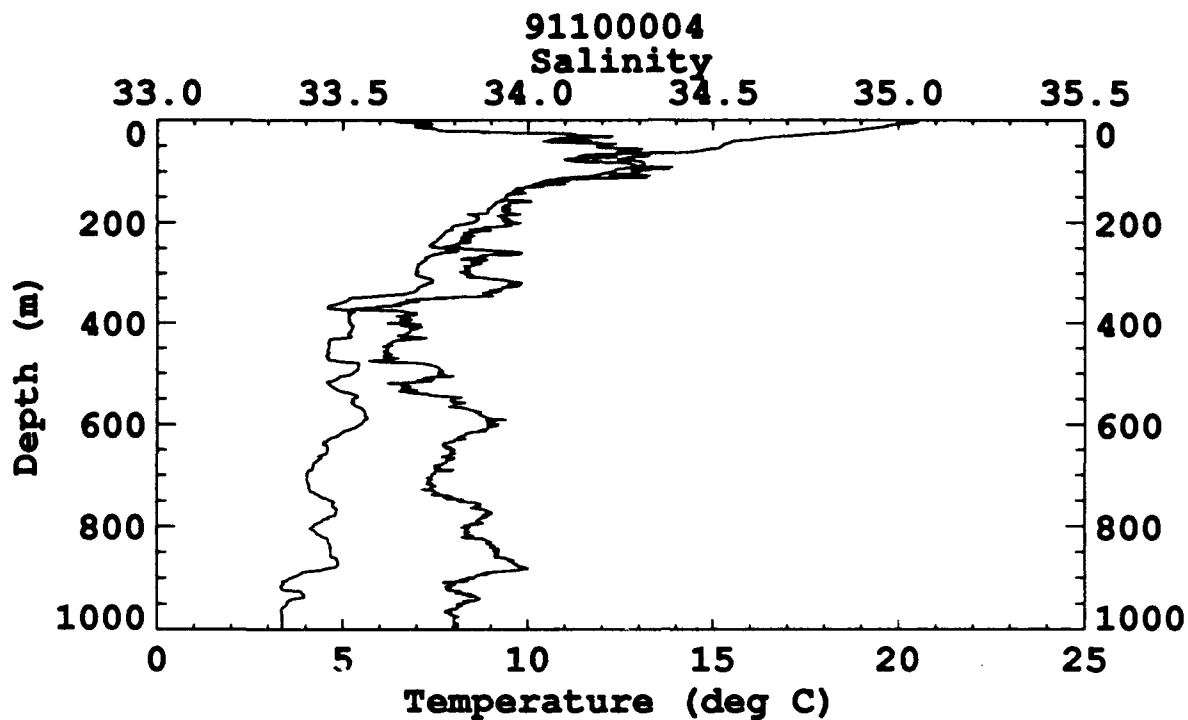


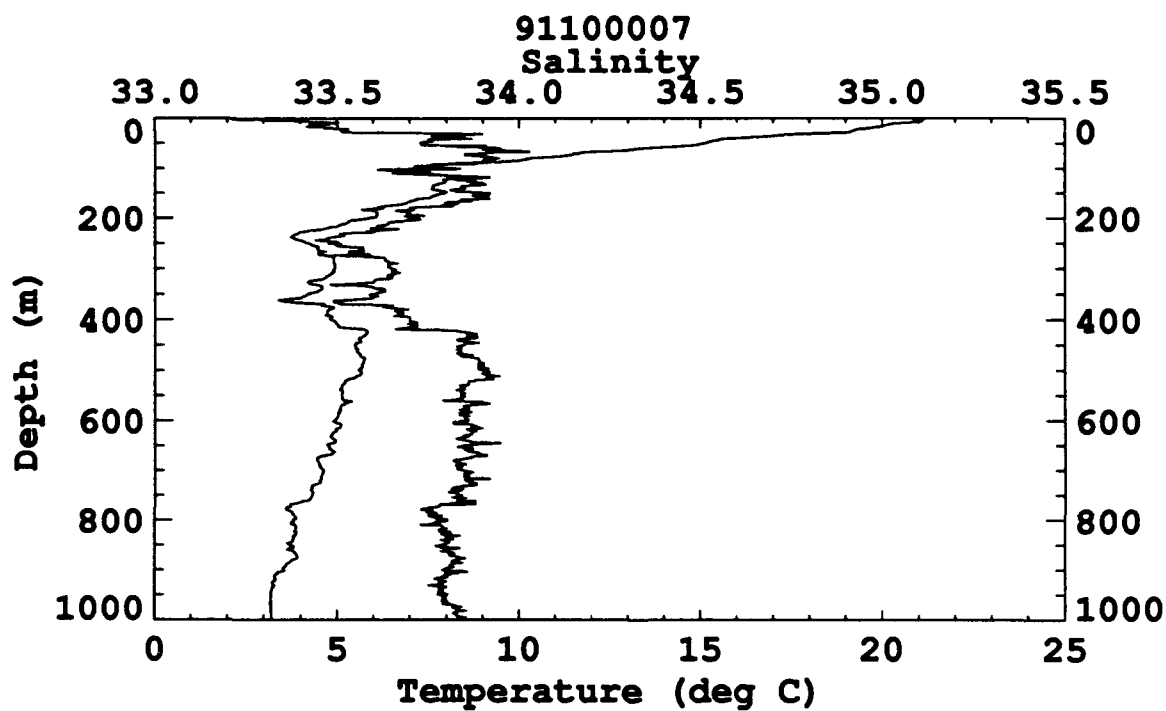
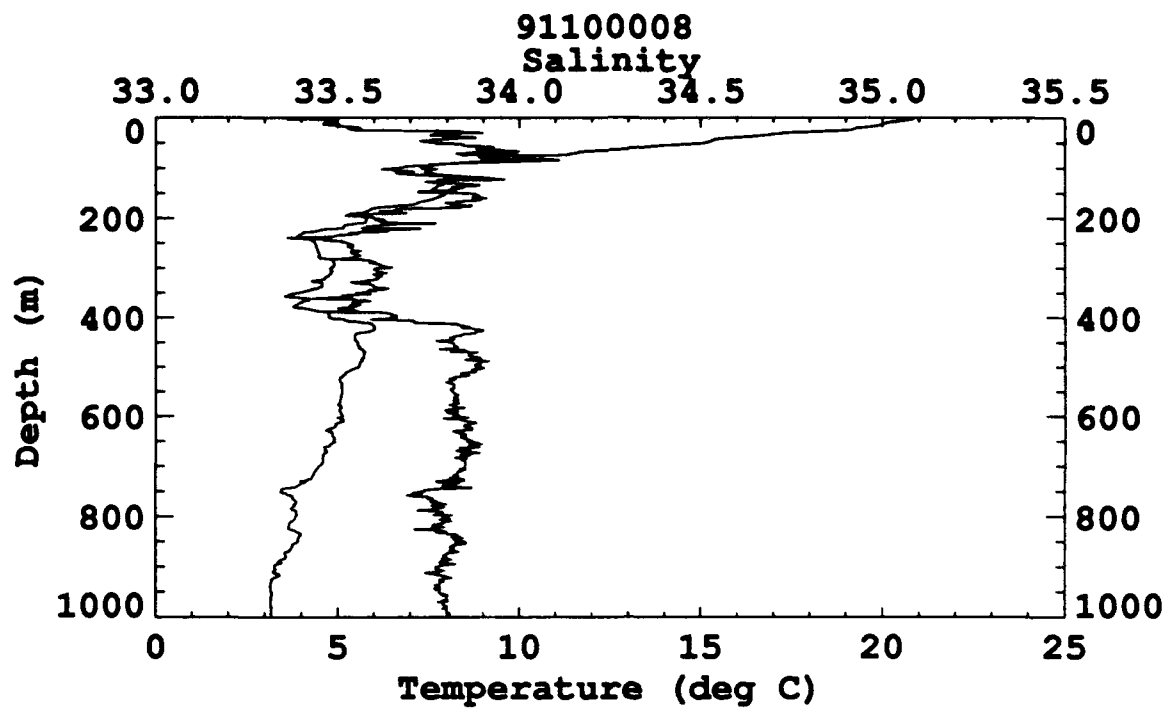


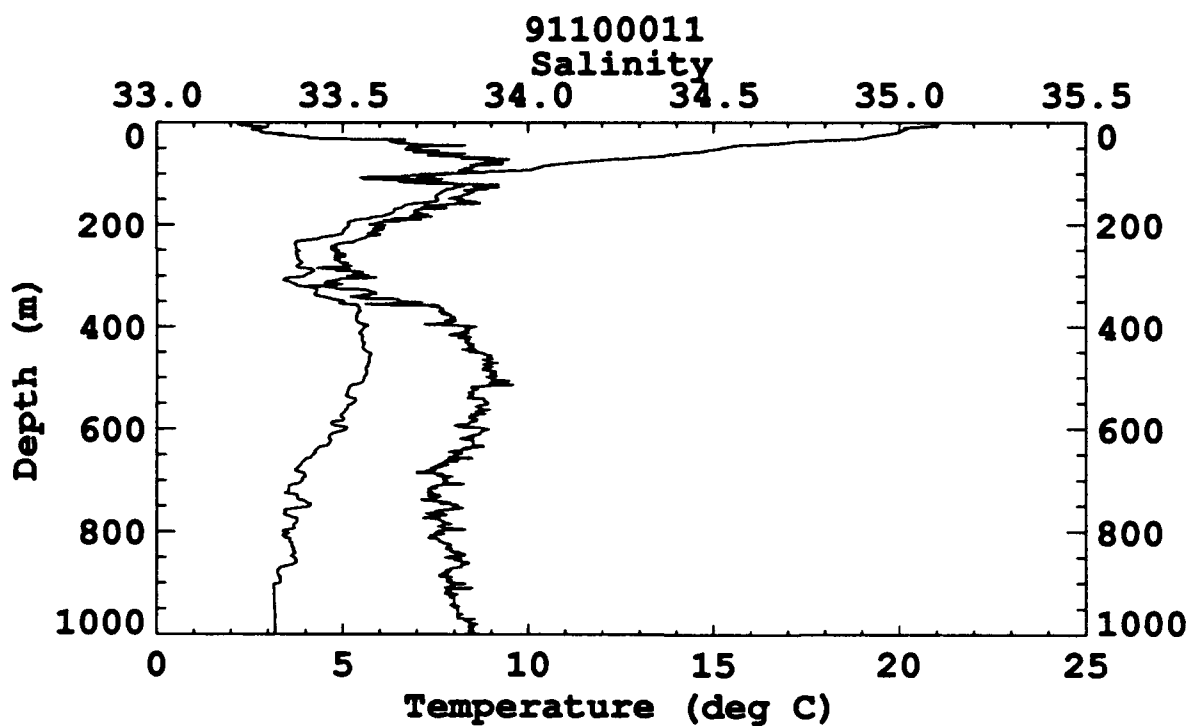
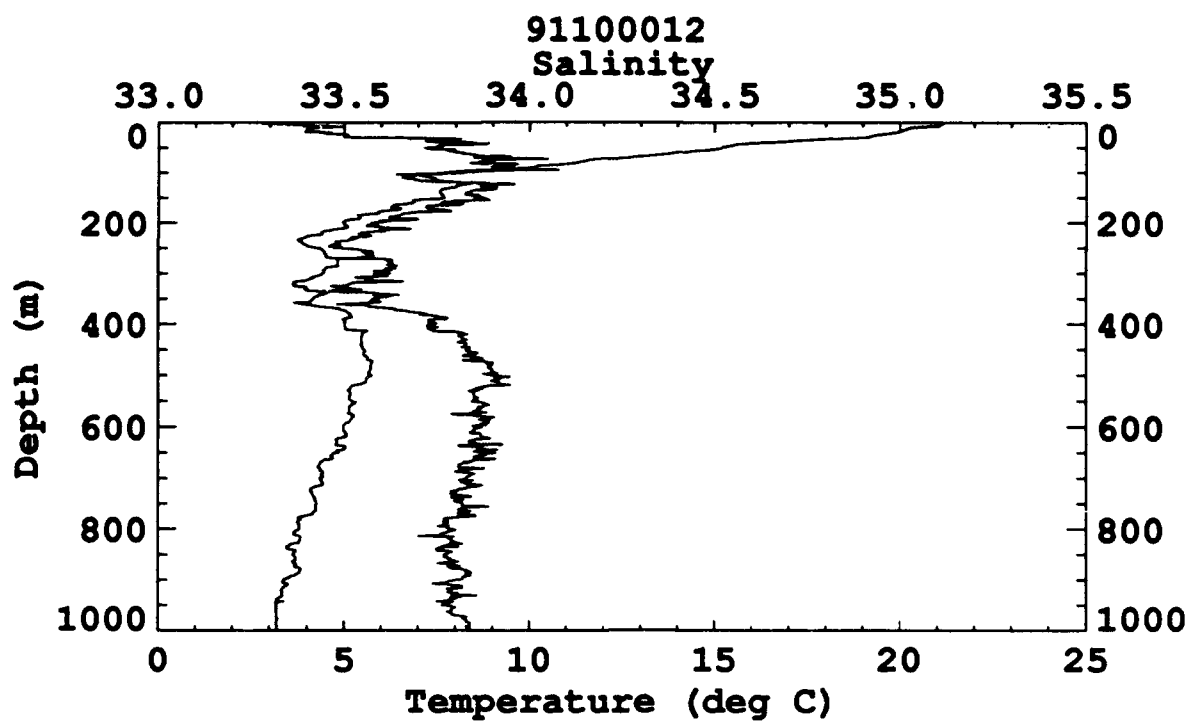


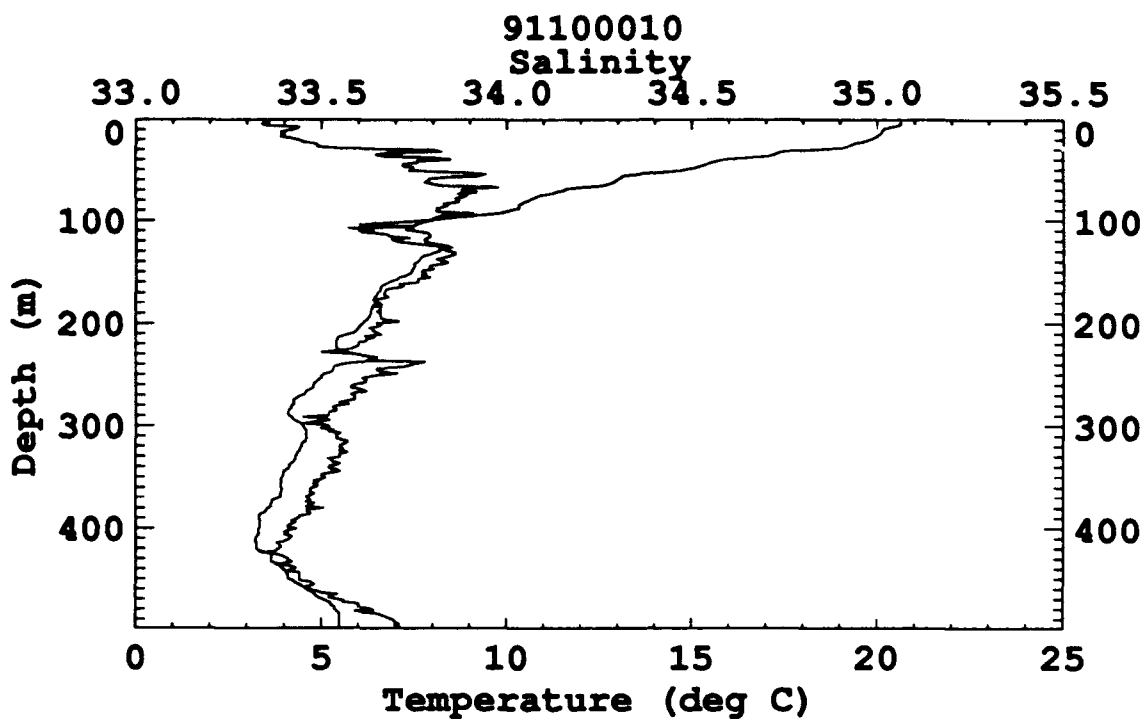







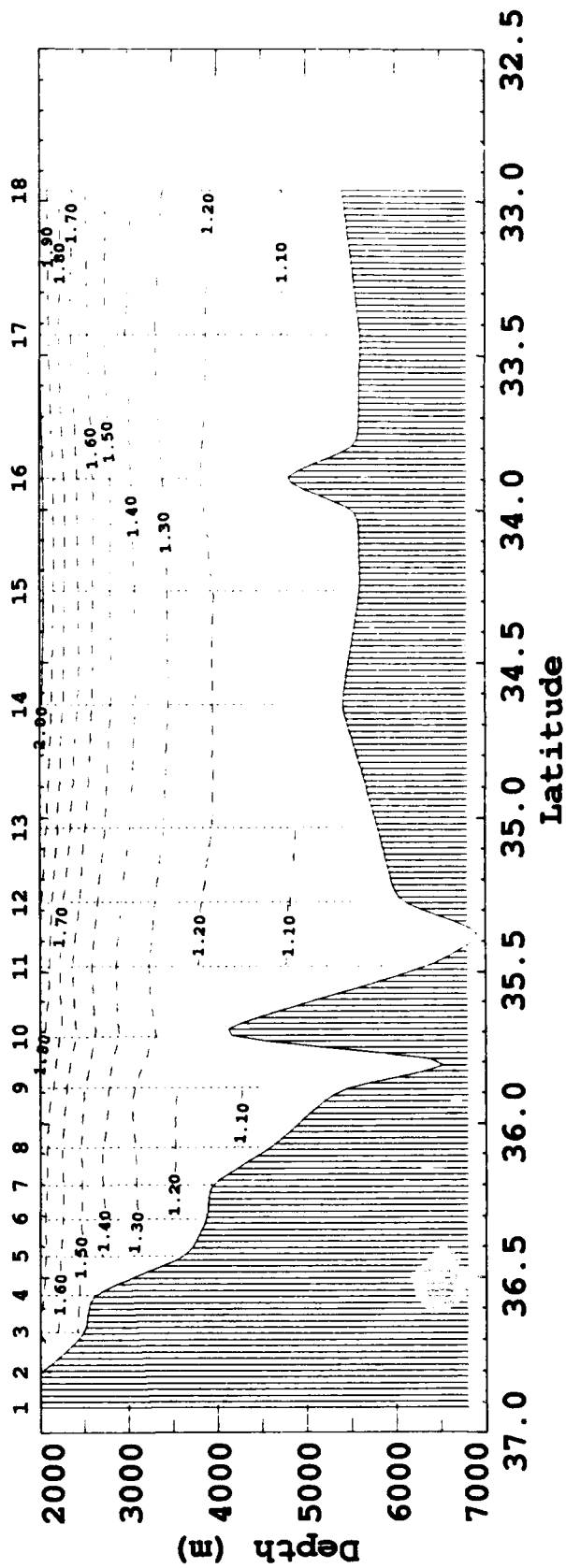
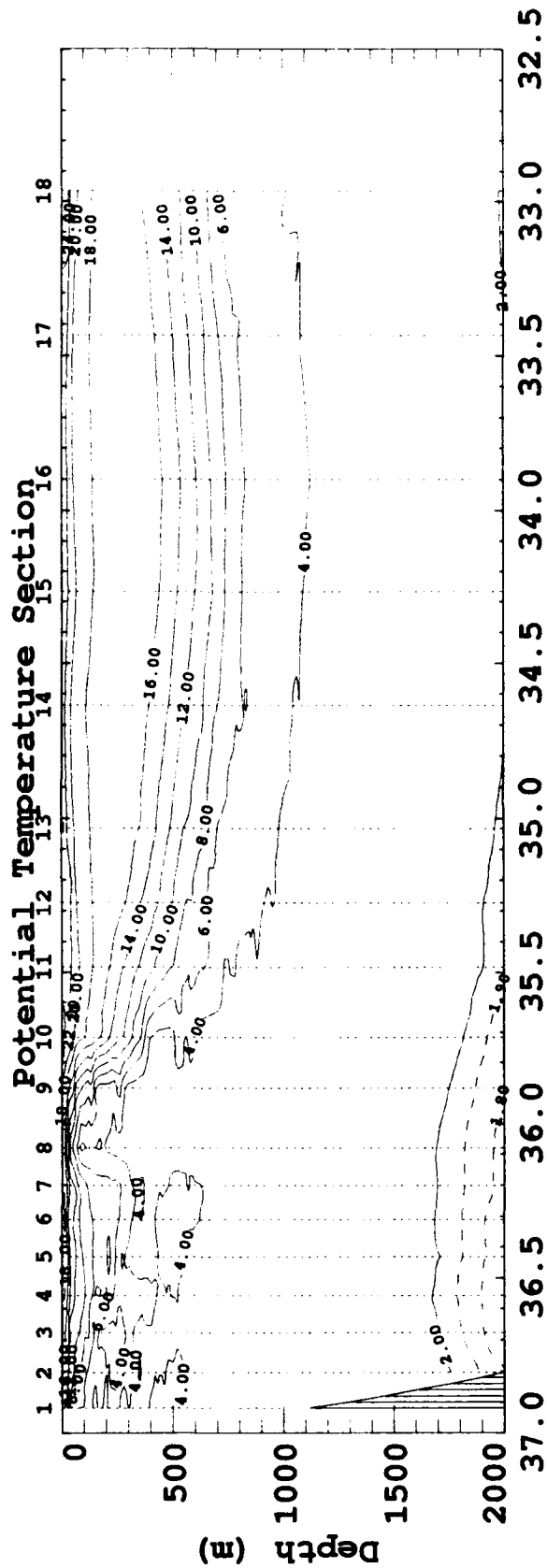


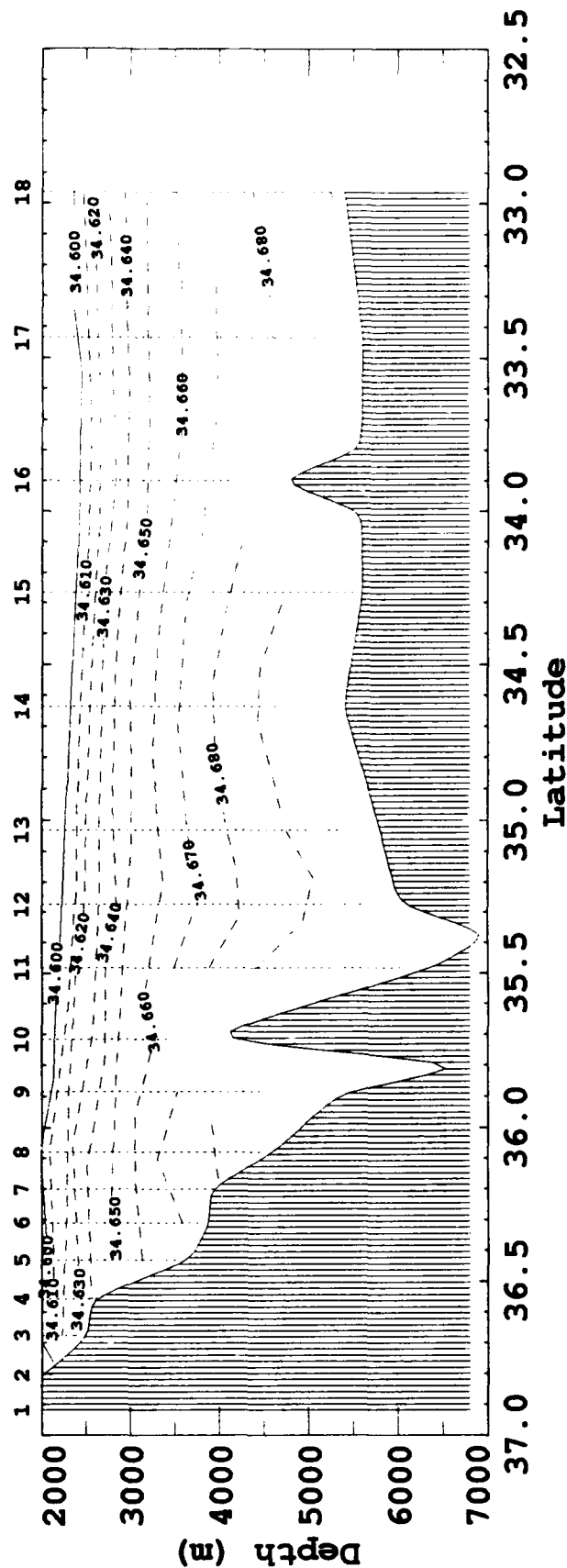
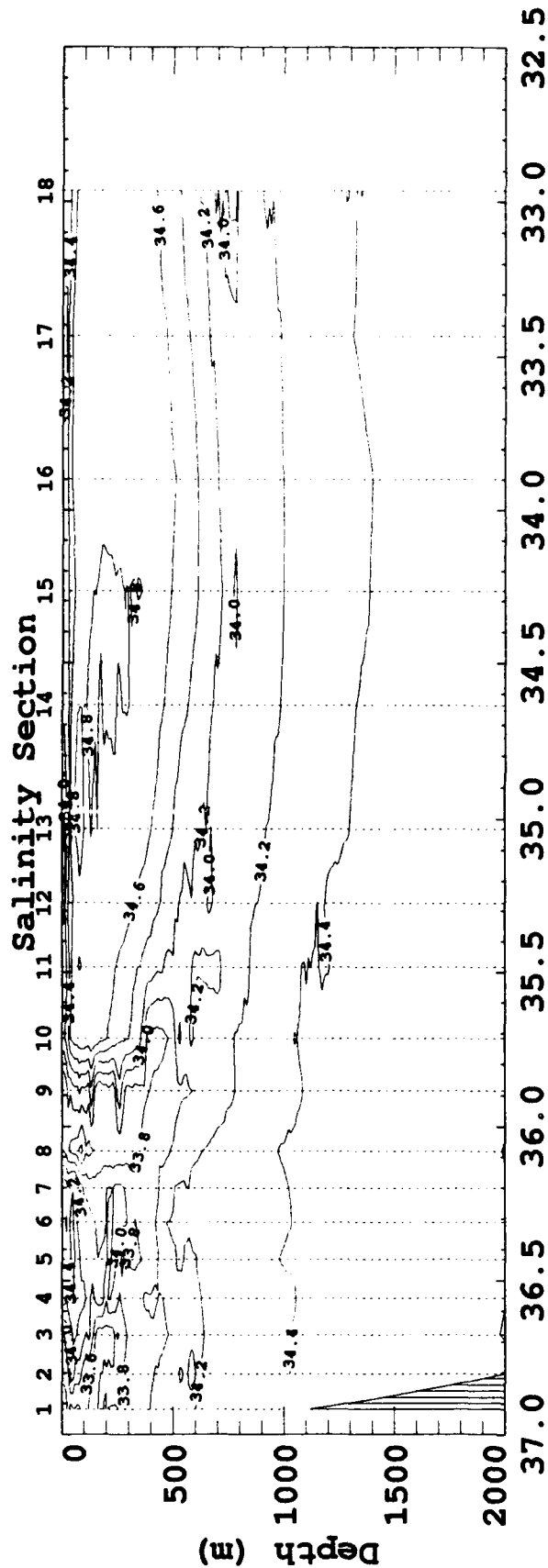




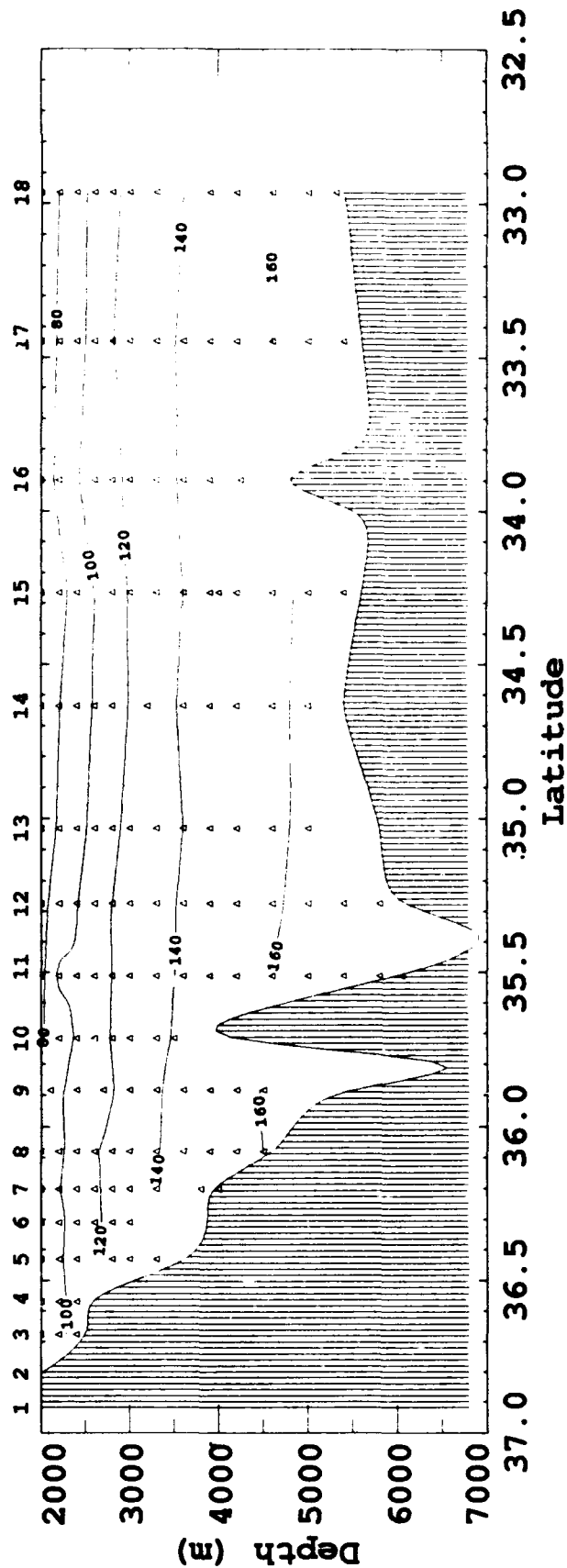
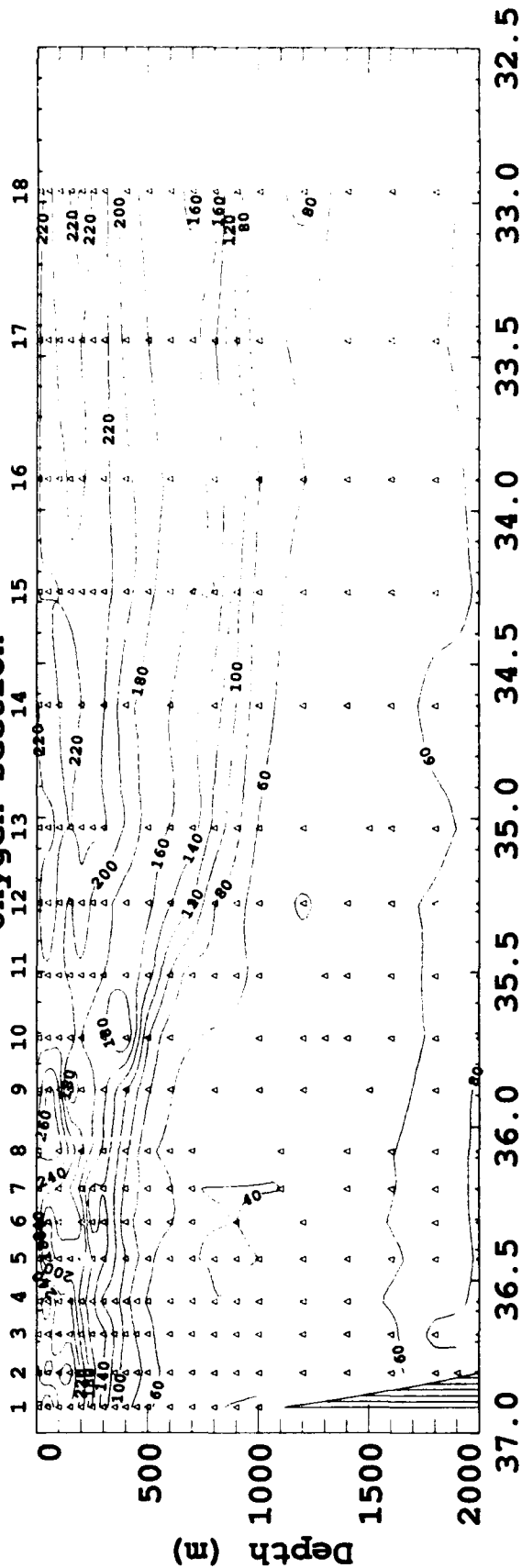


VERTICAL SECTIONS

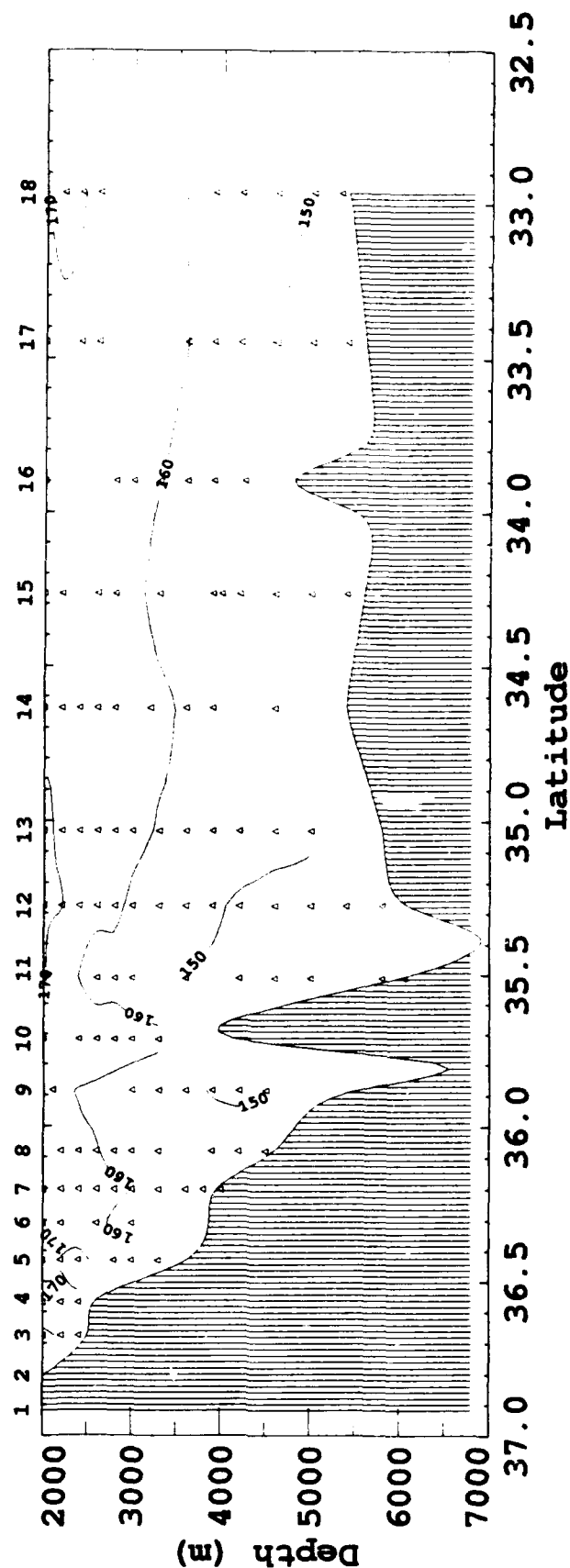
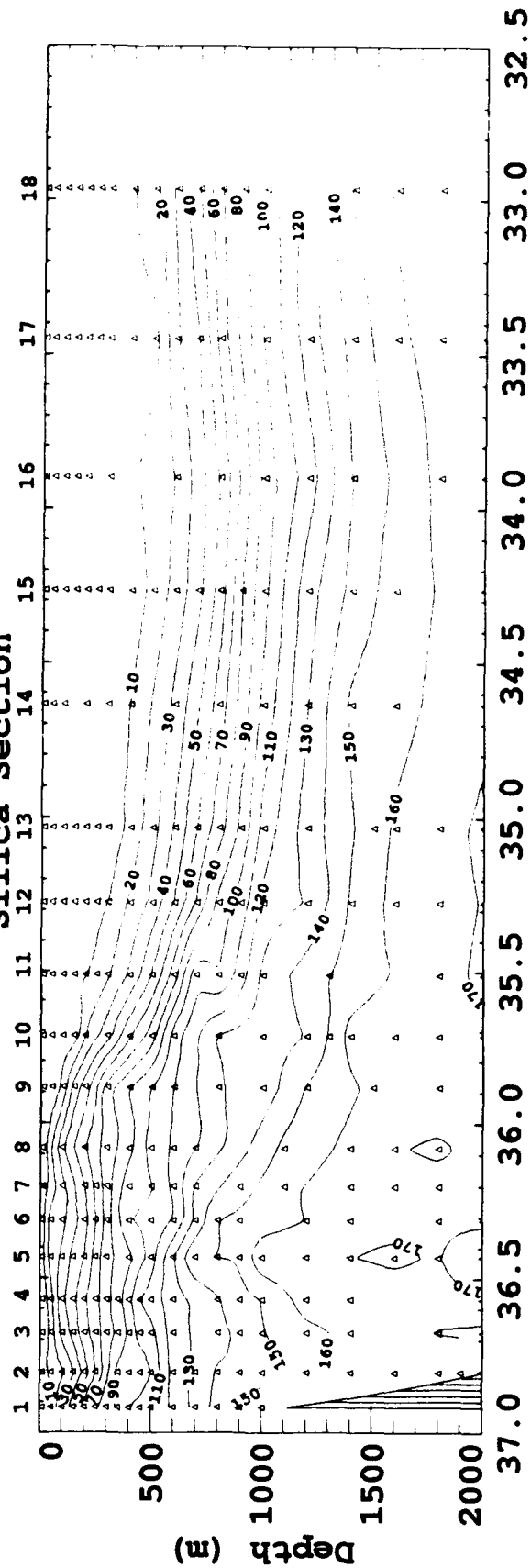




Oxygen Section



Silica Section



Nitrate Section

